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JOB PROGRESS REPORT

RESEARCH PROJECT SEGMENT

State Montana

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Program No. I Title Big Game Research

Study No. BG-1.0 Title Statewide Mule Deer Ecology Studies

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Study No. BG-2.0 Title Statewide White-tailed Deer Ecology Studies

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INTRODUCTION

The statewide deer research program was initiated in 1975. Background information on problems and needs were outlined in the 1975 Application For Federal Aid (Montana Department of Fish and Game, unpubl.) and presented in previous annual progress reports (Mackie et al. 1976-1980). Overall objectives were to:

1. provide a more detailed understanding of the population biology and habitat relationships of deer and of the factors influencing deer numbers in the diverse environments in which deer occur in Montana;

2. develop new or improved methods for measuring deer populations and habitat parameters, new guidelines for applying existing information and technology more effectively, and/or new criteria for interpreting field data in terms of management needs; and

3. establish new guidelines for consideration of the habitat requirements and relationships of deer in other game, range, forest, and land management programs and practices in Montana.

Upon completion of the first five-year project segment and general analyses of findings (Mackie et al. 1980), the program was continued as outlined in the 1980 Application For Federal Aid (Montana Department of Fish, Wildlife and Parks, unpubl.). Significant changes included the establishment of intensive studies of white-tailed deer on river bottom habitats along the lower Yellowstone River in eastern Montana in July 1980, the extension of studies on white-tailed deer in northwestern Montana to include another major coniferous forest habitat during 1981-1982, and re-establishment of the prairie-agricultural deer study as a graduate (Ph.D.) thesis research project in July 1982. A special two-year (1981-1983) graduate (MS) thesis research study of the relationships of white-tailed deer and mule deer to agriculture in the Gallatin Valley was also conducted under the project in cooperation with the Montana Agricultural Experiment Station. Goals and objectives of the 1980-1985 project segment were generally similar to those outlined earlier (above), except that greater emphasis has been given to testing hypothesis developed from investigations and findings during the 1975-1980 period. Specifically, objectives are to:

1. further determine basis biological and ecological parameters for mule deer and white-tailed deer in populations associated with the major habitats in which the two species occur in Montana. These include population size/density, reproduction/recruitment, mortality/turnover, sex/age structure, longevity, and physical condition. They also include distribution, movements, use of specific habitat/cover types, food habits, and other behavioral patterns;

2. further relate those basic biological and ecological parameters to characteristics of individual habitats or environments, including topography, physiography, vegetation, weather and climate, and land use, as well as to specific

potential limiting factors associated with individual habitats, study areas and populations. Those might include nutrition (forage production, availability, and quality), other wild ungulates, domestic livestock, livestock grazing and associated range management practices, logging and associated forest management practices, agriculture and associated cropping practices, and rural subdivisions and associated human activities. They could also include hunting, predation, diseases and parasites, and weather;

3. further develop and test hypotheses relating to findings; particularly that: natural population regulation in deer is basically effected by interaction between inherent habitat characteristics and inherent requirements and behavioral attributes of the animals; that population phenomena and dynamics are the strategy by which deer populations exploit diverse habitats; and that population dynamics are indicators of basic habitat relationships of deer in the diverse habitats in which they occur; and

4. develop new methods, criteria, and guidelines for deer management including those for: assessing mule deer and white-tailed deer population characteristics in major habitats, assessing important habitat/environmental characteristics; relating population phenomena and dynamics of the two species to habitat/environmental characteristics, and vice-versa; relating population phenomena and dynamics to specific management opportunities or constraints; relating important habitat, environmental characteristics to specific management opportunities and constraints; measuring and/or interpreting the role and importance of various "limiting factors" in deer management programs; and for consideration of the requirements and habitat relationships of deer in other land use and management programs.

The overall approach and individual study efforts continued during 1983-84 as in previous years, though field investigations were greatly reduced on studies of white-tailed deer in coniferous forest habitats as necessitated by limitations in funding and personnel and greater emphasis was placed on data compilation and analysis. Similarly, field efforts were reduced on mule deer studies in mountain-foothill habitat to direct greater personnel time and funds to data analysis.

This report compiles Job Progress Reports for individual jobs and investigations conducted on intensive study areas. The individual reports outline specific job objectives and procedures. These reports also present and discuss current findings in relation to information obtained previously. Findings and other information resulting from the studies have also been summarized in numerous separate publications. A listing of these is presented in an Appendix to this report.

STUDY NO: BG1.0 JOB NO: 1

JOB TITLE: Population ecology and habitat relationships of mule deer in the mountain-foothill habitats in southwestern Montana.

ABSTRACT:

The winter of 1983-1984 was more severe than average although severe conditions were generally restricted to late December-early January. In late April, 69 deer with recognizable neckbands and radio-collars were present on the Armstrong study area, while about 68 marked animals were present on Brackett Creek. Population data for the Armstrong winter range indicated that 271 deer were present in early winter; the number decreasing to 225 by spring. Over-winter mortality was moderate with the total reaching about 17 percent of early winter numbers. About 32-36 percent of the fawns and 10 percent of adult females died. Observed ratios from winter aerial classifications on the Armstrong range were 65 fawns:100 females, 50 fawns:100 adults, and 31 males:100 females in early winter and 34 fawns:100 adults in late winter. The spring fawn:female ratio was 45:100, indicating high recruitment. During the 1983 hunting season, an estimated 224 (56%) of 400 either-sex permit holders hunted deer in HD312 and 122 killed deer. For HD393, an estimated 812 (81%) of 1000 antlerless B-tag holders hunted deer and 480 killed deer. Population trend information indicate stable to slightly increasing numbers of mule deer in the Bridger Mountains. Fawn recruitment in spring 1984 was above average on the west slope and below average on the east slope.

JOB OBJECTIVES:

1. To determine basic biological and ecological parameters of mule deer populations associated with mountain-foothill habitats;

2. To relate those basic population parameters to (a) characteristics of individual habitats or environments and (b) specific, potential limiting factors associated with individual populations and habitats, including nutrition, other wild ungulates, domestic livestock grazing and range management practices, subdivisions and associated human activity, weather, and hunting;

3. To futher develop and test hypotheses relating to deer-habitat interactions and population regulation; and

4. To develop new methods, criteria, and guidelines for deer management within mountain-foothill habitats.

INTRODUCTION

This report summarizes findings of studies on the population ecology and habitat relationships of mule deer in the Bridger Mountains, Montana, for the period 1 July 1983 through 30 June 1984. These studies have included: (1) intensive studies of the distribution, movements, habitat use and population characteristics of mule deer associated with the Armstrong winter range, and (2) extensive studies of the seasonal distribution, habitat relations and population characteristics of mule deer throughout the Bridger Mountain Range complex. The history and general nature of both efforts were described by Mackie et al. (1978).

THE STUDY AREA

The Bridger Mountain Range (Fig. 1) is located in northeastern Gallatin and northwestern Park counties, Montana. A detailed description of topographic, climatic and vegetative characteristics of this area, including the location of major mule deer winter ranges and associated seasonal ranges was presented by Mackie et al. (1978, 1980).

METHODS

Habitat Analysis

Habitat parameters measured and general methodology employed were described by Mackie et al. (1978).

Population Studies

Various methods employed in assessment of deer population characteristics have been described in previous reports (Mackie et al. 1978, 1979). During 1983-1984, early winter helicopter (Bell 47G3B-2) surveys (Mackie, Hamlin and Pac 1981) were conducted on 1 January 1984 on the Northwest Slope winter range and Brackett Creek on 31 December 1983. In late winter, the Northwest Slope and Brackett Creek were surveyed with a Jet Ranger Helicopter on 23-25 March 1984. The other five winter ranges were surveyed with a Piper Supercub, therefore, total counts are not comparable to previous data. A separate estimate of mule deer numbers on the Armstrong winter range in spring was developed from ground observations on 7 days during April when a minimum of 85 deer were classified per survey.

Radio-collared deer within the seven population units were relocated using a Piper Supercub at monthly intervals.

Information on hunter success, hunter distribution, and the total number, sex and age structure and distribution of the deer harvest during 1983 was determined from a mail questionnaire sent to all 400 either-sex permit holders in HD312 and 1000 B-tag holders in HD393.

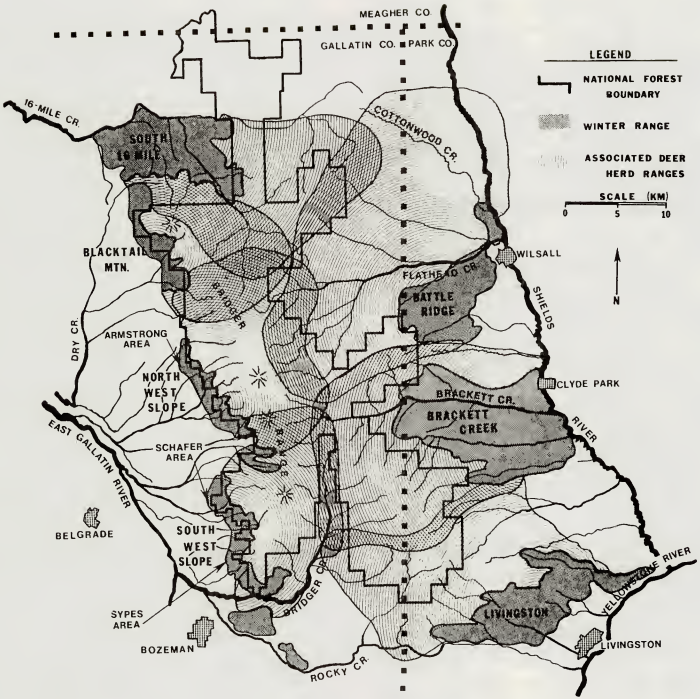

Figure 1. Map of the Bridger Range showing the location of seven mule deer year-long ranges and location of primary study areas.

RESULTS AND DISCUSSION

Weather Conditions During Winter 1983-1984.

The winter of 1983-84 for the Bozeman area was more severe than average. Only two other winters since 1971-72 have had higher severity values (Table 1). Very low temperatures and average snow depth during mid- to late-December contributed significantly to the 1983-84 winter severity index. Mild conditions during January and February were followed by above average snowfall and near average temperatures during March, April and May.

Table 1. Climatological Data, MSU Weather Station Bozeman, and severity indices, 1971-1984, November through May

	Avg. Temp. (F)	Ppt. (In.)	Total Snowfall (In.)	Max. Snow Depth (In.)	No. Days Snow On Ground	Severity[1] Index
1971-1972	33.9	7.7	81.8	10	119	-329
1972-1973	31.3	8.4	92.6	14	135	+1335
1973-1974	34.3	10.0	89.9	14	116	+2025
1974-1975	30.5	12.1	118.6	17	161	+2286
1975-1976	35.2	9.9	95.2	12	86	-810
1976-1977	37.4	7.9	57.8	9	88	-2391
1977-1978	33.9	10.0	60.5	12	111	+790
1978-1979	29.9	10.7	87.4	18	159	+7843
1979-1980	33.3	10.9	100.7	20	144	+752
1980-1981	37.6	12.9	55.6	8	74	-2871
1981-1982	32.8	11.5	125.3	11	129	+818
1982-1983	35.4	8.4	87.4	12	97	-1569
1983-1984	33.4	12.1	110.9	13	123	+2117
22-yr. mean	32.6	9.57	89.5[2]	13.08[2]	118.62[2]	+769[2]

[1] After Picton and Knight(1969). Positive values indicate greater severity.
[2] 13-year mean.

Population Characteristics

Trend and Dynamics of the Armstrong Deer Population

Spring population estimates for mule deer using the Armstrong winter range during 1973-84 are presented in Table 2. Cumulative ground observations, aerial observations, and trapping records provided data on numbers of marked deer on the area throughout winter and early spring. In late April 1984, approximately 69 deer wearing recognizable collars used the area between Tom Reese Creek and North Cottonwood Creek. Of those, 48 ranged between Bill Smith and North Cottonwood Creeks. The mean percentage of collared deer in April observations between Bill Smith and North Cottonwood Creeks was 22 percent.

Table 2. Estimated late winter-spring mule deer populations on the Armstrong winter range, 1973-1984.

Year	Total No.	No. Adult Females	Number of Males		No. Fawns
			Adult	Yrlg.	
1973	230	123	31	27	49
1974	220	130	27	23	40
1975	140	92	35	8	5
1976	170	118	37	3	12
1977	200	120	24	6	50
1978	160	116	6	6	32
1979	140	104	6	11	19
1980	160	95	14	7	44
1981	170	98	13	6	53
1982	170	102	12	20	36
1983	220	120	14	20	66
1984	225	128	23	16	58

The best estimate of mule deer numbers on the Armstrong winter range was 225 during spring 1984. The current population estimate is 2 percent higher than the estimate for spring 1983.

Estimates of mule deer numbers on the Armstrong range during early winter (Fig. 2) were reconstructed from the spring population using overwinter mortality rates of marked adults, and fawn: female and male:female ratios observed during classification flights in early January. For 1983-1984, an early winter population estimate of 271 deer included about 142 adult females, 23 adult males, 16 yearling males, and 90 fawns.

The estimated 225 deer on the Armstrong winter range in spring 1984 included approximately 128 adult females, 23 adult males, 16 yearling males, and 58 fawns (Table 2). When compared with estimates for early winter, overwinter mortality was moderate--approximately 17 percent of the early winter population. Mortality was apparently limited to fawns and old females. Seven of 70 (10 percent) marked females wintering between Tom Reese and North Cottonwood were known to have died. Overwinter changes in population estimates and the fawn: adult ratios indicated a fawn mortality rate of 32-36 percent. Known deaths included 9 old females, 1 unclassified old adult, 7 fawns, and 1 carcass of unknown sex and age in the area between Bill Smith and North Cottonwood Creeks. One old female, 3 fawns, and 1 carcass of unknown sex and age were known to have died in the area between Bill Smith and Tom Reese Creeks.

Hunting mortality of males appeared to be higher in 1983 than in the previous year. Tag returns in 1982 indicated a minimum of 3 (13 percent) of 24 marked males were killed. During the 1983 hunting season, 6 (32 percent) of 19 marked males were shot. However, 8 (42%) of 19 marked males which left the winter range in May 1983 and presumed to be alive during fall were not

observed during the following winter. Twenty-six percent of the marked males were known to be alive at the close of the 1983 hunting season.

Hunting was for males only, except for 400 either-sex permits issued for HD312 and 1000 antlerless B-tags issued for HD393. After the 1983 hunting season, a special questionnaire was sent to all either-sex permit holders in HD312, and all B-tag holders in HD393. For HD312, 315 (79 percent) of the 400 questionnaires were returned. Harvest and hunting season projections made from the returned sample indicated that 224 (56 percent) of 400 permittees actually hunted deer in HD312. Hunters averaged 3.0 days afield. Of those that hunted, 54 percent were successful. Either-sex permit holders harvested an estimated 122 deer in 1983 consisting of 80 mule deer (41 Females, 34 Males, 5 Fawns) and 42 white-tailed deer (19 females, 19 males, 4 fawns). For HD393, 791 (79 percent) of 1000 questionnaires were returned. Projections made from the returned sample indicated that 812 (81 percent) of the 1000 antlerless B-tag holders actually hunted deer in HD393. Hunters averaged 3.5 days afield. Of those that hunted, 59 percent were successful. Antlerless B-tag holders harvested an estimated 480 deer in 1983 consisting of 441 mule deer (361 females, 80 fawns) and 39 white-tailed deer (32 females, 7 fawns).

Fawn Production and Survival

Aerial classifications of mule deer on the Armstrong range during helicopter surveys in early January and late March 1984 are listed and compared in Table 3.

The observed ratios (65 fawns:100 females and 50 fawns:100 adults in 1984), indicated above average fawn survival to early winter. The late March ratio of 34 fawns:100 adults indicated that fawn survival to late winter was about average. Intensive ground classification of deer on the Armstrong range in April indicated the same fawn:adult ratio. Overwinter fawn mortality of 32-36 percent was consistent with early and late winter population estimates and changes in the fawn:adult ratio.

Late spring population estimates show 40 fawns:100 females in spring 1973, 31:100 in 1974, 5:100 in 1975, 10:100 in 1976, 42:100 in 1977, 27:100 in 1978, 18:100 in 1979, 46:100 in 1980, 54:100 in 1981, 35:100 in 1982, 55:100 in 1983, and 45:100 in 1984. Therefore, fawn survival to spring 1984 apparently was above average.

General Mule Deer Population Characteristics, 1983-1984.

Total counts on the Northwest Slope during the helicopter survey in early winter 1983-1984, were nearly the same as last year when numbers counted were the highest since surveys began in 1971 (Table 4). On Brackett Creek, the early winter count in 1983-84 was greater than all other years. Sampling efficiency, estimated from marked animals, was 60 percent on the Northwest

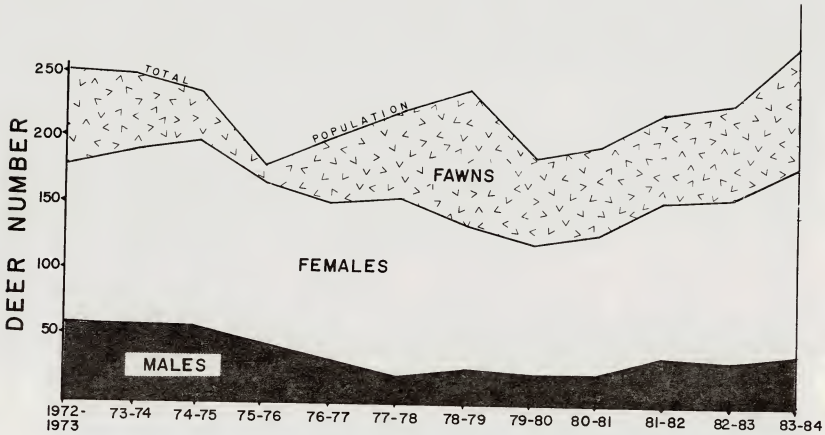

Figure 2. Early winter population trend of mule deer on the Armstrong winter range, Bridger Mountains, 1972-1984.

Table 3. Aerial classifications of mule deer on the Armstrong winter range, January 1972 through March 1984.

Reese Creek - N. Cottonwood	NUMBERS							RATIOS			PERCENTAGES		
	Total Count	Total Class.	Adults	Males	Females	Fawn	Uncl.	F:100 Females	F:100A	Males:100 Females	% Fawn	% Yrlg. Males	% Spike Yrlg. Male
1971-72 Jan. 3	173	173	119	39	80	54	-	68	45	49	31	56	26
Mar. 28	92	83	68	-	-	15	9	-	22	-	18	-	-
1972-73 Feb. 7	188	188	143	-	-	55	-	-	31	-	24	-	-
1973-74 Dec. 27	131	131	100	28	72	31	-	43	31	39	24	46	62
Apr. 1	188	188	154	-	-	34	-	-	22	-	18	-	-
1974-75 Jan. 5	140	140	116	37	79	24	-	30	21	47	17	19	17
Mar. 23	227	227	214	-	-	13	-	-	6	-	6	-	-
Apr. 20	99	99	96	-	-	3	-	-	3	-	3	-	-
1975-76 Jan. 2	121	121	113	29	84	8	-	10	7	35	7	7	100
Mar. 15	102	102	90	-	-	12	-	-	13	-	12	-	-
1976-77 Jan. 5-9	90	90	70	14	56	20	-	36	29	25	22	21	100
Mar. 10-11	116	116	87	-	-	29	-	-	33	-	25	-	-
1977-78 Dec. 19	133	133	94	11	83	39	-	47	42	13	29	46	40
Apr. 2	126	126	101	-	-	25	-	-	25	-	20	-	-
1978-79 Dec. 26	118	118	68	14	54	50	-	93	74	26	42	43	29
Mar. 12	98	98	68	-	-	30	-	-	44	-	31	-	-
1979-80 Jan. 9	132	132	83	16	67	47	-	66	56	23	36	37	50
Mar. 17	101	73	28	-	-	28	-	-	38	-	28	-	-
1980-81 Jan. 8	69	68	43	7	36	25	1	69	57	19	36	29	50
Mar. 19	129	129	83	-	-	46	-	-	55	-	36	-	-
1981-82 Dec. 27	131	131	95	23	72	36	-	50	38	32	28	61	43
Mar. 23	162	161	110	-	-	51	1	-	46	-	32	-	-
Apr. 29	137	137	107	-	-	30	-	-	28	-	22	-	-
1982-83 Dec. 20	209	205	141	31	110	64	4	58	45	28	31	58	89
Mar. 15	169	169	119	-	-	50	-	-	42	-	30	-	-
1983-84 Jan. 1	212	210	140	33	107	70	2	65	50	31	33	42	64
Mar. 25	210	210	157	-	-	53	-	-	34	-	25	-	-

Table 4. Numbers and sex and age ratios of mule deer classified by aerial (helicopter or Super Cub) survey on various winter ranges in the Bridger Mountain complex during early and late winter, 1971-72 through 1983-84.

		1971-72		1972-73		1973-74		1974-75		1975-76		1976-77		1977-78		1978-79		1979-80		1980-81		1981-82		1982-83		1983-84	
		Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late	Early	Late
NO. END	No. Classif.	204	352	523	-	367	356(1)	412	600	388	266	236	281	325	315	302	252	205	325	69	362	414	489	451	457	444	575
	dd:100 ♀♀	39.6	-	-	-	39.8	-	31.1	-	29.9	-	24.7	-	19.7	-	16.7	-	18.8	-	19.4	-	39.6	-	28.6	-	28.9	-
WEST SLOPE	FF:100 ♀♀	62.3	-	-	-	38.3	-	34.8	-	9.2	-	37.0	-	48.7	-	84.7	-	66.2	-	69.4	-	58.9	-	61.5	-	64.0	-
	FF:100 AD	44.6	29.9	32.7		27.4	19.0	26.5	9.4	7.1	6.1	29.6	34.4	40.7	30.3	72.5	39.9	55.7	46.4	56.8	63.1	42.2	46.1	47.8	41.3	49.4	34.0
SO. END	No. Classif.	470	332	271		174	162	459	468	335	307	335	365	336	121	277	473	325	504	-	571	-	566	-	700	-	572(3)
	dd:100 ♀♀	39.1	-	-		39.6	-	22.8	-	23.6	-	27.2	-	25.0	-	11.2	-	20.4	-	-	-	-	-	-	-	-	-
WEST SLOPE	FF:100 ♀♀	45.4	-	-		32.6	-	51.1	-	47.8	-	46.1	-	53.7	-	61.2	-	61.4	-	-	-	-	-	-	-	-	-
	FF:100 AD	32.6	26.7	38.1		23.4	14.8	41.6	31.7	29.0	12.0	36.2	30.8	42.9	31.2	55.0	39.9	50.9	43.5	-	54.7	-	47.6	-	41.1	-	38.0
BLACKTAIL MOUNTAIN	No. Classif.	-	-	-		-	-	79	-	174	-	69	133	221	93	172	92	-	191	-	194	-	240	-	237	-	334(3)
	dd:100 ♀♀	-	-	-		-	-	48.6	-	31.3	-	24.3	-	19.2	-	11.9	-	-	-	-	-	-	-	-	-	-	-
	FF:100 ♀♀	-	-	-		-	-	64.8	-	37.7	-	62.1	-	50.7	-	90.4	-	-	-	-	-	-	-	-	-	-	-
	FF:100 AD	-	-	-		-	-	43.6	-	33.8	-	50.0	37.1	42.5	40.9	80.8	27.8	-	59.1	-	59.0	-	42.9	-	41.9	-	25.0
SOUTH 16-MILE	No. Classif.	-	-	-		-	-	378	-	390	-	307	-	543	-	601	728	-	725	-	881	-	988	-	1279	-	888(3)
	dd:100 ♀♀	-	-	-		-	-	6.2	-	14.2	-	5.0	-	7.5	-	14.0	-	-	-	-	-	-	-	-	-	-	-
	FF:100 ♀♀	-	-	-		-	-	24.5	-	23.4	-	49.2	-	68.2	-	67.7	-	-	-	-	-	-	-	-	-	-	-
	FF:100 AD	-	-	-		-	-	23.1	-	19.3	-	46.6	-	63.4	-	59.4	46.8	-	71.3	-	80.9	-	49.7	-	34.1	-	27.0
NORTH 16-MILE	No. Classif.	-	-	-		-	-	665	483(2)	766	725	814	831	910	1050	1267	1041	766	1204	-	-	-	-	-	-	-	-
	dd:100 ♀♀	-	-	-		-	-	6.6	-	13.9	-	8.0	-	9.5	-	14.9	-	16.8	-	-	-	-	-	-	-	-	-
	FF:100 ♀♀	-	-	-		-	-	35.4	-	23.6	-	43.3	-	67.8	-	77.5	-	88.8	-	-	-	-	-	-	-	-	-
	FF:100 AD	-	-	-		-	-	33.2	32.7	23.1	10.0	40.0	25.9	61.9	39.3	67.6	47.6	76.4	65.8	-	-	-	-	-	-	-	-
BATTLE RIDGE	No. Classif.	-	-	-		-	-	-	-	48	-	81	-	388	-	629	515	-	656	-	396	-	808	-	812	-	635(3)
	dd:100 ♀♀	-	-	-		-	-	-	-	4.3	-	24.5	-	22.8	-	24.6	-	-	-	-	-	-	-	-	-	-	-
	FF:100 ♀♀	-	-	-		-	-	-	-	23.6	-	54.3	-	70.2	-	96.1	-	-	-	-	-	-	-	-	-	-	-
	FF:100 AD	-	-	-		-	-	-	-	21.3	-	47.2	-	63.7	-	77.1	42.7	-	65.7	-	94.1	-	61.0	-	45.0	-	31.0
BRACKETT CREEK	No. Classif.	-	-	-		-	-	299	-	360	-	-	-	978	509	1120	1057	579	1017	446	1212	1293	1707	1200	1612	1348	1590
	dd:100 ♀♀	-	-	-		-	-	11.3	-	5.0	-	-	-	12.2	-	13.1	-	7.5	-	11.3	-	12.7	-	15.1	-	13.0	-
	FF:100 ♀♀	-	-	-		-	-	49.4	-	31.5	-	-	-	74.1	-	77.2	-	81.7	-	91.3	-	79.4	-	82.6	-	60.0	-
	FF:100 AD	-	-	-		-	-	44.4	-	31.0	-	-	-	66.0	51.2	68.1	31.1	76.2	64.8	82.0	97.4	70.5	58.9	54.0	40.4	53.1	42.0
LIVINGSTON-BILLMAN CR.	No. Classif.	-	-	-		-	-	300	-	323	-	-	-	266	-	660	436	-	496	-	587	-	638	-	667	-	436(3)
	dd:100 ♀♀	-	-	-		-	-	12.8	-	13.7	-	-	-	18.9	-	24.1	-	-	-	-	-	-	-	-	-	-	-
	FF:100 ♀♀	-	-	-		-	-	41.0	-	39.1	-	-	-	67.1	-	74.4	-	-	-	-	-	-	-	-	-	-	-
	FF:100 AD	-	-	-		-	-	36.3	-	31.6	-	-	-	56.4	-	57.6	28.2	-	63.1	-	95.7	-	36.3	-	41.6	-	39.0
OTHER MISCELLANEOUS AREAS	No. Classif.	-	-	-		-	-	-	-	-	-	-	-	28	-	26	-	-	27	-	-	-	-	-	-	-	-
	dd:100 ♀♀	-	-	-		-	-	-	-	-	-	-	-	7.1	-	11.1	-	-	-	-	-	-	-	-	-	-	-
	FF:100 ♀♀	-	-	-		-	-	-	-	-	-	-	-	92.9	-	100.0	-	-	-	-	-	-	-	-	-	-	-
	FF:100 AD	-	-	-		-	-	-	-	-	-	-	-	86.9	-	90.0	-	-	100	-	-	-	-	-	-	-	-
BRIDGER RANGE TOTALS	No. Classif.	674	648	794		541	518	2592	1531	2784	1298	1842	1610	4060	2088	4854	4594	1882	3651	515	4203	1767	5436	1651	5764	1792	5030
	dd:100 ♀♀	39.3	-	-		39.7	-	14.8	-	11.5	-	13.7	-	14.6	-	16.0	-	19.2	-	12.5	-	18.8	-	18.6	-	16.6	-
	FF:100 ♀♀	50.3	-	-		36.4	-	38.7	-	29.1	-	45.0	-	66.4	-	77.7	-	78.1	-	88.3	-	74.8	-	62.0	-	61.0	-
	FF:100 AD	36.1	28.3	34.4		26.1	18.5	33.7	22.3	21.5	9.7	39.6	29.3	58.6	39.9	66.9	43.9	67.9	47.2	78.2	81.3	62.9	51.4	52.3	40.0	52.3	35.0

(1) Not including 109 unclassified
(2) Northwest of 16-Mile Creek only
(3) Super Cub survey

Slope. No sampling efficiency was estimated for early winter on Brackett Creek.

In late winter, only the Northwest Slope and Brackett Creek were surveyed by helicopter. Sampling efficiencies were 57 percent on the Northwest Slope and 63 percent on Brackett Creek. Sampling efficiencies were not available for the other five winter ranges surveyed with a Piper Supercub (Table 4). Therefore, a population estimate could not be calculated for the entire Bridger Range. Trend information for the Northwest Slope and Brackett Creek indicate populations were stable to slightly increasing as compared to last year. Fawn recruitment for spring 1984 was generally above average for west slope populations and significantly below average for east slope populations.

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STUDY NO. BG-1.0 JOB NO. 2

JOB TITLE: Population ecology and habitat relationships of mule deer in river breaks habitat in northcentral Montana.

ABSTRACT:

The population estimate for mule deer in early winter 1983-84 was the highest ever made, approaching 16 deer/square mile. Overwinter mortality of fawns (75%) and adults (10-15%) resulted in a spring population estimate that was about 65 percent of the early winter estimate. Fawn recruitment was the poorest since 1975-76. Because the population was so high in early winter, the extensive winter mortality only reduced the population to about the same level as during the 3 previous spring periods. The total number of white-tailed deer observed during the population survey was also the highest ever observed. Almost all deaths of fawns and adults recorded during winter and summer were the result of coyote predation. Most deer killed during winter were in very poor physical condition. Preliminary data indicate that fawn production and survival will be very poor during 1984-85.

JOB OBJECTIVES:

1. To determine basic biological and ecological parameters of mule deer populations associated with timbered breaks habitat of central and eastern Montana;

2. To relate those basic population parameters to (a) characteristics of specific individual habitats or environments and (b) specific, potential limiting factors associated with individual populations and habitats, including nutrition, other wild ungulates, domestic livestock grazing and range management practices, coyote predation, weather, and hunting;

3. To further develop and test hypothesis relating to deer-habitat interactions and population regulation; and

4. To develop new methods, criteria, and guidelines for deer management, generally, and specifically, for timbered breaks habitats.

INTRODUCTION

In 1960, an intensive study of mule deer and their relationship to elk and domestic livestock was established on a representative 75,000 acre area in the Missouri River Breaks approximately 25 miles northeast of Roy, Montana. Habitat use and population studies were conducted from June 1960 through September 1963 and intermittently from October 1963 through May 1964 (Mackie 1970). From the summer of 1964 through spring 1975, less intensive studies were continued on the area primarily to obtain population data for mule deer (Mackie 1966, 1973, and 1976).

In July 1975, intensive studies resumed under the statewide deer research program to further evaluate factors regulating mule deer populations in the breaks type habitat of eastern Montana. Results through June 1982 were reported previously (Hamlin 1977, 1978, 1979, 1980, 1981, 1982, 1983, and Knowles 1976.). In 1976, special studies were established to evaluate coyote-deer relationships. These included graduate thesis research projects investigating mortality of mule deer fawns during summer (Dood 1978, Riley 1982) and the distribution and abundance of small mammals (Trout 1978). They also included determination of coyote population characteristics and trends (Pyrah 1980, Schladweiler 1980). During the summer of 1976, a special study was also established to measure annual production of various grasses, forbs and browse species on various habitat types and to relate forage production to seasonal and annual weather conditions (Jorgensen 1982).

This report summarizes data collected during 1983-84 concerning deer population trends and characteristics and their relationship to environmental factors. Data on coyote population trends are summarized and discussed in Appendix A, while data on forage production and trends are presented and discussed in Appendix B.

STUDY AREA

The south study area encompasses all of the timbered "breaks" portion of the area described by Mackie (1970) as extending approximately 20 miles on a 4 to 7 mile wide belt adjacent to the Missouri River in Fergus County, Montana (Fig. 1). It comprises approximately 100 square miles between U.S. Highway 191 on the west, the Skyline Trail on the east, the Missouri River on the north and the Musselshell trail on the south. Physiography, climate, land use and vegetation of this area were described in detail by Mackie (1970). Some of the work described in this report was conducted on the adjacent Missouri River Bottomlands described by Allen (1968) and NE across the river on the Nichols Coulee Resource Conservation Area (north study area) described by Knowles (1975).

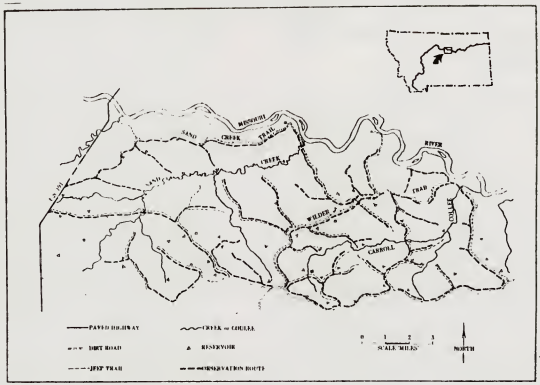

Figure 1. Map of the study area.

METHODS

Population data were obtained during fixed-wing surveys at various times of the year and helicopter surveys during December and March (Mackie, Hamlin and Pac 1980). Sex and age classifications and deer distribution and habitat use were obtained during all aerial surveys. Population estimates were made using data from helicopter surveys in most years. During the last 5 years, sufficient numbers of marked deer were present on the study area to permit use of the Lincoln Index (Overton and Davis 1969) for all aerial surveys. Supplementary information was obtained throughout the year from the ground during the course of normal activities.

Data on initial fawn production and subsequent fawn survival were obtained by aerial and ground reconnaissance. Survival was also measured by following radio-collared fawns. The river and reservoir ice was flown periodically during winter to check for coyote-killed deer. The uplands were checked for coyote-killed deer during aerial flights to relocate collared deer and during other normal activities. Carcasses are listed as probable coyote kills based on evidence of tracks in the snow, trails of blood on snow or vegetation and other site evidence. Deer have been captured during winter in order to attach radio transmitters or observational collars. Methods have included the cannon net (Mackie et al. 1975), the Clover trap (Clover 1954), a helicopter drive net, and darting from a helicopter. Newborn fawns are caught by the method described by Dood (1978).

Aerial relocations of radio-collared deer were obtained at 1-2 week intervals and relocations from the ground were made as time permitted.

Other techniques have been described in previous reports (Hamlin 1977, 1978, 1979, 1980).

RESULTS

Mule Deer Population Trend

Fawn recruitment to 6 months of age was the lowest in 6 years, and recruitment to 12 months was the lowest since 1975-76 (Table 1 and Table 2). The early winter population estimate for 1983-84 (Fig. 2, Table 3) was the highest ever made, almost 16 deer per square mile. There were some indications that estimates for 1982-83 may have been too low. The higher estimate for 1982-83 is presented in Table 3. Very low hunting pressure and low dispersal apparently contributed to the population increases. Extensive overwinter mortality during 1983-84 resulted in a late winter population estimate that was about 65 percent of the early winter estimate (Table 3). Because the deer population was so high entering winter, the extensive mortality only reduced the population to about the same level as in late winter-spring for the last 3 years.

White-tailed Deer Population Trend

The total number of white-tailed deer observed during the survey was the highest ever (Table 4). Recruitment was also relatively high, contrasting with the trend for mule deer. No data were collected during late winter-spring for white-tailed deer, so it is not known if they suffered the same degree of overwinter mortality as mule deer.

Mule Deer Production and Mortality

Initial fawn production during June 1983 was average and a large proportion of non-producing yearling females limited the total expected production ratio below previous highs (Table 5).

Twenty-seven percent of the 11 radio-collared fawns died during summer 1983 (Table 6). All 3 deaths were the result of coyote predation. Summer fawn mortality as determined by the change in age ratio method was 33 percent, comparing well with the percent determined with the small radio-collared sample. Fawn mortality during fall was relatively low at 10-12 percent. The over-winter fawn mortality rate was about 75 percent, the highest since winter 1975-76.

Table 1. Sex and age composition of mule deer population on the Missouri Breaks Study Area, 1960-61 through 1983-84. Data were derived as aerial or ground classifications during December or early January of each year except 1969-70 and 1972-73, when classifications were completed during February and March, respectively.

Year	Type of Observation	Number Classified	Percentage			Ratios			% of Yrlg. Males	
			Males	Females	Fawns	Males: 100 FF	Fawns: 100 FF	Fawns: 100 AD	Obsv.	Harv.
1960-61	Ground[1]	668	9.3	48.6	42.1	19.1	86.4	72.6	56	46
1961-62	Ground	430	15.5	60.7	24.0	25.3	39.5	31.5	74	47
1962-63	Ground	190	19.5	52.1	28.4	37.5	54.5	39.7	63	34
1963-64	Aerial[2]	362	16.0	45.6	38.4	35.1	84.2	63.3	47	36
1964-65	Aerial	611	22.7	47.8	29.5	47.6	61.6	41.7	47	43
1965-66	Aerial	434	21.4	58.1	20.5	36.9	35.3	25.8	33	13
1966-67	Aerial	289	17.3	52.6	30.1	32.9	57.2	43.1	46	
1967-68	Aerial[3]	115	20.0	40.0	40.0	50.0	100.0	66.7	--	
1968-69	None	-	-	-	-	-	-	-	--	
1969-70	Aerial	110	-	-	38.1	-	-	64.2	--	
1970-71	Aerial	776	18.8	48.1	33.1	39.1	68.9	49.5	47	
1971-72	Aerial	679	19.0	53.8	27.2	26.1	50.6	37.4	46	
1972-73	Aerial	235	-	-	19.1	-	-	23.7	--	
1973-74	Aerial	370	24.1	49.5	26.5	48.6	53.6	36.0	43	
1974-75	Aerial	315	25.6	55.1	19.3	46.0	35.1	24.0	50	
1975-76	Aerial	323	15.5	57.6	26.9	26.9	46.8	36.9	28	
1976-77	Aerial	258	17.4	57.4	25.2	30.4	43.9	33.6	40	
1977-78	Aerial	322	10.9	58.7	30.4	18.5	51.9	43.8	48	
1978-79	Aerial	501	13.2	42.3	44.5	31.1	105.2	80.2	55	
1979-80	Aerial	675	11.3	41.0	47.7	27.4	116.2	91.2	54	
1980-81	Aerial	850	12.5	45.8	41.8	27.2	91.3	71.7	64	
1981-82	Aerial	1055	11.9	49.3	38.8	24.2	78.7	63.3	64	
1982-83	Aerial	931	10.5	49.1	40.4	21.4	82.3	67.7	46	
1983-84	Aerial	1221	16.1	50.0	33.9	32.3	67.9	51.3	65	

[1]Cumulative observations on area during December.
[2]All aerial observations by helicopter except 1969-70 (fixed--wing aircraft).
[3]Only west half of study area surveyed in 1967-68.

Table 2. Classifications and observed recruitment of fawns on the south side Missouri Breaks study area, 1975-76 through 1983-84

Date	Numbers	Adults	Young	Females	Males	Uncl.	Fawns/ 100 Adults	Fawns/ 100 FF
Sept.-Oct. 1975	105	69	36	50	19	-	52	72
December 1975	323	236	87	186	50	-	37	47
March 1976	193	173	19	--	--	-	11	--
October 1976	159	110	49	79	31	-	45	62
December 1976	258	193	65	148	45	-	34	44
March 1977	293	225	68	--	--	-	30	--
October 1977	112	70	41	51	20	-	59	80
December 1977	322	224	98	189	35	-	44	52
March 1978	255	195	51	--	--	9	26	--
September 1978	176	102	74	69	33	-	73	107
December 1978	501	278	223	212	66	-	80	105
March 1979	409	248	161	--	--	-	65	--
October 1979	278	157	120	100	57	1	76	120
January 1980	680	353	322	277	76	5	91	116
March 1980	683	375	308	--	--	-	82	--

Table 2. Continued.

Date	Numbers	Adults	Young	Females	Males	Uncl.	Fawns/ 100 Adults	Fawns/ 100 FF
September 1980	548	355	190	216	139	3	54	88
January 1981	854	495	355	389	106	4	72	91
March 1981	747	458	280	--	--	9	61	--
September 1981	671	447	230	292	151	-	51	79
December 1981	1062	646	409	520	126	7	51	79
March 1982	869	570	299	--	--	-	53	--
April 1982	295	205	90	--	--	-	44	--
October 1982	501	331	170	235	96	-	51	72
December 1982	934	555	376	457	98	3	68	82
March 1983	731	431	263	--	--	37	61	--
April 1983	493	307	181	--	--	5	59	--
October 1983	721	470	245	324	146	6	52	76
December 1983	1221	807	414	610	197	-	51	68
March 1984	855	679	167	--	--	9	25	--
May 1984	122	108	14	--	--	-	13	--

Table 3. Population estimates of mule deer on the south Missouri River Breaks study area.[1]

	Males	Females	Fawns	TOTAL
1977-78 Early Winter	55	295	150	500
Late Winter	50	280	85	415
	43	42		
Predicted E. Winter 1978-79	93	322		
1978-79 Early Winter	95	310	325	735
Late Winter	90	295	250	635
	125	125		
Predicted E. Winter 1979-80	215	420		
1979-80 Early Winter	115	410	475	1000
Late Winter	105	395	410	910
	205	205		
Predicted E. Winter 1980-81	310	600		
1980-81 Early Winter	135	505	460	1100
Late Winter	130	480	370	980
	185	185		
Predicted E. Winter 1981-82	315	665		
1981-82 Early Winter	155	655	515	1325
Late Winter	145	615	335	1095
	168	167		
Predicted E. Winter 1982-83	313	782		
1982-83 Early Winter	135	625	515	1275
Late Winter	130	610	440	1180
	220	220		
Predicted E. Winter 1983-84	350	830		
1983-84 Early Winter	255	780	530	1565
Late Winter	220	670	115	1005
	58	57		
Predicted E. Winter 1984-85	278	727		

[1]Early and late winter estimates are based on Lincoln Indexes, changes in sex and age ratios, and other indicators (Mackie et al. 1980). Predicted levels do not take hunting loss, dispersal or other mortality occurring between June and December into account.

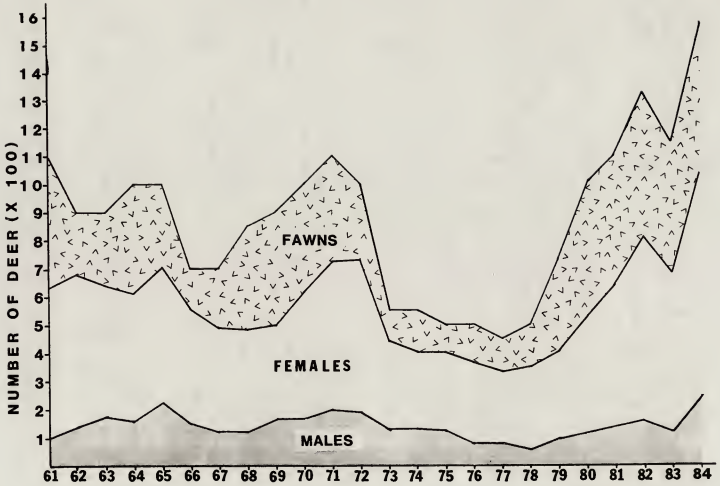

Figure 2. Mule deer population trend on the south study area, early winter 1961-1983.

One of the radio-collared fawns was shot during hunting season; the remaining radio-collared fawns with functioning collars were all killed by coyotes during winter. An estimated 85 percent of fawns born in June 1983 were dead by June 1984.

Probable coyote-killed deer found during winter are listed in Table 7. Winter 1983-84 resulted in the second highest number of coyote-killed deer found since records were initiated during winter 1975-76. A minimum of 10 percent of marked adult females died during winter 1983-84. Six of 7 of these females were known to be killed by coyotes. Another 5 marked adult females are still unaccounted for, so mortality could have been as high as 17 percent.

Drought conditions for the last several years have resulted in many deer in poor physical condition. Adult females nursing fawns throughout summer often did not recover sufficient fat reserves by winter. Examination of femur marrow samples indicated that almost all coyote-killed deer were in very poor physical condition during winter 1983-84. Percent femur marrow fat for coyote-killed adult females was significantly lower than for a random sample of collected females.

Known hunter-kills during 1983 were 58 adult males, 17 adult females, and 9 fawns. Known buck harvest was higher than during 1982, but antlerless harvest was at about half of prior levels during 1983. The decline in antlerless harvest probably resulted because no B-tags were issued for the study area during 1983.

A sample of 15 adult females collected during winter 1983-84 revealed an in utero fetal rate of 1.47 fetuses/female. This ratio is slightly below the lowest fawn-at-heel ratios observed during June, from 1976 through 1983. The corresponding fawn-at-heel ratio during June 1984 was 1.39 fawns/female, confirming the lower than usual in utero productivity. Also, because of poor fawn survival from 1983, only about 8 percent of females should have been non-productive yearlings during June 1984. Behavioral data (grouping characteristics) indicated that about 31 percent of females were non-productive during June 1984. These data indicate that 1984-85 may be a poor year for fawn production and survival.

Fall and winter mortality of fawns was low. One radio-collared fawn died as the result of coyote predation during winter. Probable coyote-killed deer found during winter are listed in Table 7. Winter 1982-83 was extremely mild and fewer coyote-killed deer were found than in previous years of the study.

Known hunting loss during 1982 was 39 adult males, 33 adult females and 11 fawns. The antlerless harvest was about the same as 1981, but the buck harvest was only about half that recorded in the previous two years. Preliminary data indicated that fewer bucks were available for harvest during 1982 than during the previous 2 years. During 1979, 1980, and 1981, the sex ratio of

Table 4. White-tailed deer numbers and sex and age composition from early winter surveys, 1960-1984.

Year	Numbers					Ratios			
	Total	Adult	Young	Female	Male	YG:100 AD	YG:100 Females	Male:100 Females	% Yearling Males
1960-61[1]	28	10	10	--	--	55.5	--	--	--
1961-62[1]	120	54	66	--	--	122.2	--	--	--
1962-63[1]	106	76	30	--	--	39.5	--	--	--
1964-65[2]	188	168	20	123	45	11.9	16.3	36.6	36.8
1965-66[2]	178	137	41	110	27	29.9	37.3	24.5	15.0
1966-67[2]	223	162	61	121	41	37.6	50.4	33.9	25.6
1971-72[2]	267	182	60	139	43	33.0	43.2	30.1	--
1973-74[2]	207	168	39	146	22	23.2	26.7	15.1	40.9
1975-76[2]	121	105	16	76	29	15.2	21.0	38.2	27.6
1976-77[2]	18	15	3	10	5	20.0	30.0	50.0	66.7
1977-78[2]	110	96	14	58	38	14.6	24.1	65.5	44.7
1978-79[2]	90	69	21	53	16	30.4	39.6	30.2	43.8
1979-80[3]	141	75	66	66	9	88.0	100.0	13.6	22.2
1980-81[4]	160	116	44	77	39	37.9	57.1	50.6	64.9
1981-82[4]	183	138	45	92	46	32.6	48.9	50.0	54.3
1982-83[4]	71	51	17	33	18	33.3	51.5	54.5	38.9
1983-84[4]	290[5]	162	70	--	--	43.2	--	--	--

[1] [2]Ground sample classification
[3]Helicopter surveys
[3]Super Cub survey - 1-16-80, some males had probably lost their antlers, so both yg:100 female and male:100 female ratios would be somewhat higher than shown in the Table.
[4]Super Cub survey
[5]58 unclassified white-tailed deer

Table 5. Estimated mule deer fawn/female ratios in June, 1976-1984.

	Fawns/100 Producing Females		Percent Females Producing		Estimated Population Fawn/Doe Ratio
June 1976	150:100(14)[1]	x	94[2]3	=	141:100
June 1977	152:100(27)	x	82[3]	=	125:100
June 1978	165:100(26)	x	90[2]	=	148:100
June 1979	176:100(37)	x	70[2]	=	123:100
June 1980	168:100(22)	x	75[2]	=	126:100
June 1981	162:100(26)	x	78[2]	=	126:100
June 1982	157:100(32)	x	67[2]	=	105:100
June 1983	159:100(32)	x	72[3]	=	114:100
June 1984	139:100(31)	x	69[3]	=	96:100

[1]Female sample size in parentheses.
[2]Percent of female population older than yearling.
[3]Percent of females observed alone or with fawns.

Table 6. Summer mortality and causes for marked mule deer fawns 1976-1983.

Year	No. Fawns Monitored	No. Died	% Mort.	No. Definite or Probable Coyote Killed	No. Unknown	No. Accident	% Coyote Killed
1976[1]	10	4	40	4	--	--	100
1977[1]2	18	6	33	5	--	1	83
1978[2]	12	2	17	1	1	--	50
1979[2]	17	2	12	2	--	--	100
1980[2]	15	2	13	2	--	--	100
1981	19	4	21	4	--	--	100
1982	17	5	29	4	1	--	80
1983	11	3	27	3	--	--	100
Total	119	28	24	25	2	1	89

[1]Data from Dood (1978) and personal communication.
[2]Data from Riley (1981) and personal communication.

Table 7. Probable coyote-killed deer found during winter (December-March).

	Uplands	Bottomlands	River Ice	Reservoir Ice	Total
Mule Deer					
1975-76	9	2	1	33	45
1976-77	4	0	3	9	16
1977-78	5	0	2	1	8
1978-79	3	0	1	1	5
1979-80	0	0	2	5	7
1980-81	2	0	5	2	9
1981-82	10	1	1	1	13
1982-83	1	0	1	0	2
1983-84	12	0	3	1	16
White-tailed Deer					
1975-76	1	10	9	0	20
1976-77	0	1	3	0	4
1977-78	0	1	0	0	1
1978-79	0	1	1	0	2
1979-80	0	0	1	0	1
1980-81	0	0	2	0	2
1981-82	0	0	1	0	1
1982-83	0	0	1	0	1
1983-84	0	0	4	0	4

fawns recruited to 1 year old was about 100 males: 100 females. During 1982, the recruited yearling sex ratio was 46 males: 100 females. The drop in buck harvest may have been the result of a change in the sex ratio of recruited fawns-yearlings.

The either-sex hunting season for the last two years has given the opportunity for some data to be collected on crippling loss and/or illegal kill as a percentage of known legal kill. For the 1981 and 1982 hunting seasons combined, the crippling loss and/or illegal kill for antlerless deer amounted to 10.8 percent of the known legal kill. For the years 1976 through 1982, the comparable figure for adult males was 1.7 percent.

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Submitted by: Kenneth L. Hamlin

APPENDIX A

Coyote Population Characteristics and Trends in the Missouri River Breaks, 1976-1983.

by

Duane B. Pyrah

Kenneth L. Hamlin

INTRODUCTION

This report presents findings of the 1983 surveys (Pyrah 1980), observed litter counts, and observations of radio-marked coyotes.

RESULTS AND DISCUSSION

Coyotes made their first large population increase in 1983 (Table 1). More dens (17 to 22) and larger litters (2.3 to 4.1) accounted for the increase.

Table 2 contains results of the siren surveys. More coyotes were heard on the Wilder-Sand Creek route (59 to 73) but fewer on the Musselshell-Skyline route (53 to 45). The highest count on any night was made on the Wilder-Sand Creek route on 16-17 August when 60 coyotes were estimated to be heard.

More litters were observed during 1983 than in any previous year (Table 3). Observations of litters in 68% (15/22) of the den areas would indicate good coverage of the den area surveys.

Breaks habitats continued to support a higher density than did prairie habitats (Table 4). However, prairie habitats appear to have recovered to their 1976 level.

The last radio (4-7, Carroll male) ceased transmitting about 7 January 1984 after 1693 days covering over 4.6 years and 5 den seasons. The lactating female, trapped in Gumbo Coulee in 1977, was found dead during an aerial survey on 14 May 1984. She was observed in den area B for the battery life of the radio during 1977 and 1978, and in all probability remained there every year. She would have been a minimum of 8 years old when she died and had used the same den area for that long or longer. These longevities are longer than any other known published records.

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Table 1. Combined (siren, den area) survey for coyotes in the Missouri River breaks deer study area, 1977-83.

Den Area	1977			1978			1979			1980			1981			1982			1983		
	SA[1]	DAE[1]	HC[1]	SA	DAE	HC	SA	DAE	HC	SA	DAE	HC	SA	DAE	HC	SA	DAE	HC	SA	DAE	HC
A	4	6.2	6.2	1		1	4	5.2	5.2	4	3	3	0	3	3	3	4.3	4.3	0	0	0
B	3	6.2	6.2	1	5.8	5.8	4	5.2	5.2	5	4.8	5	1	4.9	4.9	5	4.3	5	2	4	4
C		5.2	5.2	5	5.8	5.8	4	6	6	3	4.8	4.8	0	2	2	3	4.3	4.3	2	6.1[3]	6.1
D	1		1		5.8	5.8	6	5	6	5	4.8	5	3	4	4	6	3	6	5	5	5
E	8	5.2	8	5	5.8	5.8	5	7	7	7	4.8	7	6	5	6	6	4.3	6	9	5	9
F	2		2	1		1	6	6	6	4	4.8	4.8	6	9	9	5	3	5	4	3	4
G	6	9.2	9.2	6	7	7	6	5.2	6	5	5	5	7	4.9	7	7	6	7	4	6.1	6.1
H				4	6	6	5	6.2	6.2	4	3	4	6	5.9	6	4	6	6	5	6.1	6.1
I	1	7	7	8	5.8	8	6	5	6	7	4.8	7	5	7	7	7	4.3	7	4	4	4
J		6	6		5.8	5.8	7	8	8	3	3	3	4	4.9	4.9	1	3	3	1	6	6
K	2		2	8	5.8	8	2	5.2	5.2	3	6	6	4	4.9	4.9	4	4.3	4.3	1	0	1
L				2		2		6	6	4	4.8	4.8	3	4	4	5	4.3	5	2	6	6
M	6	5.2	6	1	8	8	4	5.2	5.2	6	4.8	6	1	3	3	5[2]	4.3	5	5	8	8
N	1		1	1	6	6		3	3	2	0	2	3	4.9	4.9	2[2]	4.3	4.3	5	6.1	6.1
O		5.2	5.2		5.8	5.8		6	6	3	4.8	4.8	5	4	5	0		0	6	6	6
P	1	5	5	1	6	6	3	5	5	2	8	8	6	5	6	3	5	5	5	7	7
Q		7	7	2	5	5		3	3	0	0	0	2	2	2	0		0	0	5	5
R		6	6	5	5	5		5.2	5.2	0	6	6	0	6	6	4	4	4	0	6	6
S	4	6.2	6.2		5	5	5	5.2	5.2	1	0	1	1	1	1	0		0	4	6.1	6.1
X1													6	6	6	3	4.3	4.3	0	6.1[4]	6.1
E1																			7	8	8
I1																			6	7	7
L1																			0	9	9
M1																			3	6.1	6.1
Total	39	79.6	89.2	51	94.4	102.8	67	102.6	105.4	68	77.2	87.2	69	91.4	96.6	73	73	85.5	80	131.7	137.7

1/ SA = Siren Answers; DAE = Den Area Estimates; HC = High Count.
2/ 4 answered the siren at a listening station not on the route.
3/ Litter heard.
4/ 1 pup dead.

Table 2. Summary of siren survey coyote responses for high counts at each station, south study area, Missouri River breaks, 1976-83.

Route	Year	Number of Coyotes	Number of Stations	Average Coyotes per Station	Density of Coyotes[1/]	
					100 km^2	100 mi^2
Wilder-Sand Cr.	1976	56	11	5.09	28	72
	1977	51	12	4.25	23	60
	1978	35	12	2.92	16	41
	1979	56	12	4.67	25	66
	1980	62	13	4.77	26	67
	1981	52	13	4.00	22	57
	1982	59	13	4.54	25	64
	1983	73	13	5.62	31	79
	Avg.[2/]	56	12	4.48	24	63
Musselshell-Skyline	1976	50	10	5.00	27	69
	1977	33	10	3.30	18	46
	1978	40	11	3.64	20	52
	1979	28	11	2.55	14	36
	1980	46	11	4.18	23	60
	1981	59	11	5.36	29	75
	1982	53	11	4.82	26	67
	1983	45	11	4.09	22	57
	Avg.[2/]	44	11	4.12	23	58
Totals	1976	106	21	5.05	27	70
	1977	84	22	3.82	21	54
	1978	75	23	3.26	18	47
	1979	88	23	3.83	20	52
	1980	108	24	4.50	25	65
	1981	111	24	4.62	25	65
	1982	112	24	4.67	26	67
	1983	118	24	4.92	27	70
	Avg.[2/]	100	23	4.33	24	61

[1/] Assumes a 7.07 mi^2 listening area; 100 km^2 = 38.6 mi^2.
[2/] 8-yr arithmetic average; columns 4, 5, and 6 are derived by calculation each year but not for the 8-yr average.

Table 3. Yearly frequency distribution of observed coyote litters in the Missouri River breaks, 1976-83.

Litter Size	1976	1977	1978	1979	1980	1981	1982	1983	Total
1				2	2	2	3	1	10
2			2	1		4	1[1/]	1	9
3	3	4	1	3	1	1	1	4	18
4	1	1	3	4	3	2	2	4	20
5	1		1			1		3	6
6			1	1		1		2[1/]	5
7	1							1	2
Total Litters	6	5	8	11	6	11	7	16	70
Total Young	25	16	30	35	17	32	16	65	236
Average Litter	4.2	3.2	3.8	3.2	2.8	2.9	2.3	4.1	3.4

1/ 1 dead pup observed nearby

Table 4. Comparison of coyote density and population trend between breaks and prairie habitats by siren responses assigned to den areas, Missouri River breaks, 1976-83.

	Breaks (263 km^2)		Prairie (172 km^2)	
Year	No.	Density ($/km^2$)[1/]	No.	Density ($/km^2$)[1/]
1976	57	0.22	35	0.20
1977	39	0.15	21	0.12
1978	51	0.19	23	0.13
1979	67	0.25	12	0.07
1980	68	0.26	32	0.19
1981	69	0.26	30	0.17
1982	73	0.28	30	0.17
1983	80	0.30	38	0.22
Avg.	63	0.24*	28	0.16*

1/ Density of responding coyotes, not corrected for estimates of non-responders.

* Difference significant at $P < 0.02$ ($t = 3.237$, 6 df).

APPENDIX B

Forage Production and Trends in the Missouri River Breaks, 1976-1983

by

Henry E. Jorgensen

INTRODUCTION

This study of production of grasses, forbs and browse on selected habitat types within the Missouri River Breaks study area was established in 1976 to evaluate the response of various forage classes and species to weather conditions, the ultimate goal being to learn how to predict forage production from weather data. Through June 1980, the study was conducted within the framework of statewide habitat studies to evaluate existing range survey methods, concepts and criteria and develop practical methods of monitoring condition trends on big game ranges. During 1980, the study was included as part of investigations of population ecology and habitat relationships of mule deer in the Missouri River Breaks. In 1981, it was discovered from concurrent shrub ring width studies that widths of certain shrub annual growth rings were highly correlated with certain parameters of forage production. This report presents results of clipping studies during the summer of 1983 in relation to those of previous years.

Procedures for the clipping study followed those described by Jorgensen and Mackie (1978).

RESULTS

The production of grass, of all the categories of vegetation sampled in this study, was the most similar between macroplots (sample sites) and appeared to be most consistently related to variations in moisture conditions between years. Grass production in 1983 was about average for the eight-year period (Table 1); production of forbs was close to the low end of the scale.

In 1983, production of Comandra was significantly less than all other years on both sites. Production varied more strongly and was consistently higher on site 2 than site 1, but production on neither site appeared related to weather conditions. Yellow sweetclover production in 1983 was average at site 1 and much higher than average on site 2.

Dry matter production of sagebrush flower leaders was extremely low in 1983. Total shrub dry matter production was not determined in 1983.

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Table 1. Current annual production (Kg./ha.) on two sites in the sagebrush, bluebunch wheatgrass habitat type, Missouri Breaks, 1976-1983.

Stand 1								
Species[1]	1976	1977	1978	1979	1980	1981	1982	1983
COUM	85ab[2]	101a	87ab	87ab	56babc	30bc	14c	11c
MEOF	15	=0	72	464	0.62	2.6	41	40
FORBS	16b	10b	72a	8b	12b	72a	95a	33b
GRASS	291c	236cd	550a	288c	178d	392b	609a	329bc
ARTR[3]	8bc	30b	ND[4]	3c	30bc	96a	51b	4c

Stand 2								
Species[1]	1976	1977	1978	1979	1980	1981	1982	1983
COUM	162ab	135bd	197a	182ab	139bc	104d	78d	7e
MEOF	0.3	=0	11	0.4	=0	1.5	21	285
FORBS	15c	4c	116b	10c	14c	136b	220a	15c
GRASS	461c	272d	1030a	437c	251d	526c	893b	477c
ARTR[3]	11b	8b	ND	5b	13b	63a	59a	.4b

[1]Species abbreviations: COUM: Comandra umbellata (bastard toadflax)
MEOF: Melilotus officinale (Yellow sweetclover)
ARTR: Artimisia tridentata (big sagebrush)

[2]Letters denote significant or nonsignificant differences between years. The same letter for any of the years means that the differences were not significant and vice versa.

[3]Flower leaders only.

[4]No data collected.

STUDY NO. BG-1.0

JOB NO. 3

JOB TITLE: Population ecology and habitat relations of mule deer in prairie-agricultural habitat.

ABSTRACT:

This report summarizes data from continuing studies of the ecology of mule deer in prairie-agricultural habitat in eastern Montana. Included are descriptions of vegetative cover types on the Terry Study Area and tentative findings relating to distribution, movements, use of cover types and specific habitat sites, population characteristics and dynamics, and hunter harvests. habitat use and population characteristics and dynamics of white-tailed deer obtained for purposes of evaluating interspecific and land-use relationships, are presented comparatively.

JOB OBJECTIVES:

1. Describe the demographics and habitat use patterns of mule deer in prairie-agricultural habitat.
2. Develop criteria and efficiency indices for estimating seasonal population sizes ad population units.
3. Develop guidelines for determining allowable harvests for mule deer in this habitat.

INTRODUCTION

This report provides a summary of data collected in continuation of studies previously conducted from June 1975 to June 1980 (Hamlin 1980) and July 1982 to July 1983 (Wood 1983). The study area is located in eastern Montana, approximately 19 km (12 miles) northwest of the town of Terry, in Prairie County, and lies in the northeast corner of deer hunting district 715. It is approximately 490 km^2 (190 mi^2) in size. The features of the landscape fit the general patterns for prairie mule deer habitat described by Severson (1981).

The help of numerous people from Montana State University, Montana Department of Fish, Wildlife and Parks (MDFWP), the Bureau of Land Management (BLM), the U.S. Livestock and Range Research Station (USLRRS) in Miles City, and many private landowners who provided assistance over the past year, is gratefully acknowledged. Special thanks are extended to Dan Bricco and Gerry Gill of the BLM, Steve Gniadek formerly of the BLM and now a student at the University of Montana, Robert Short from the USLRRS, and pilots Keith Kinden, Jeff Tachenko, and Larry Schweitzer for their individual efforts.

METHODS

Deer were trapped in January and February using a drive net (Beason et al. 1980) and hand held net-gun (Barrett et al. 1982). Each deer was ear tagged and fitted with an individually recognizable neckband or radio transmitter. All marked deer were aged by tooth replacement and wear (Robinette et al. 1957). Blood samples were collected to determine pregnancy rates and condition (Wood et al. in prep.). Additional data on the age structure of the population were gathered by collecting jaws from hunter harvested deer during the fall of 1983. Ages were determined by tooth wear and replacement and by cementum analysis (Thomas and Bandy 1973).

Aerial population surveys were conducted in January, April, July, and October from a Piper Supercub. The surveys followed drainage patterns to ensure coverage of the entire study area. Ground surveys were conducted throughout the year using a pickup truck. Survey routes were arranged throughout the entire study area to insure the sampling of each population segment. Routes travelled were adjusted seasonally to accommodate changes in deer distribution. Both types of surveys provided data to generate Lincoln index estimates of population size (Davis and Winstead 1980) in additional to providing distribution and density data. Marked animals were followed throughout the year, from the air and ground, to provide data on home range size, habitat use, and mortality rates.

Harvest estimates were generated from population estimates, change-in-ratio formulae (Davis and Winstead 1980), and from a special hunter harvest survey. A special survey of all "B" tag holders in hunting district 715 was conducted to determine the distribution of the harvest through the hunting district. This survey was necessary to provide comparisons between MDFWP harvest estimates and harvest estimates within the study area, which covers only a portion of the hunting district. This was accomplished by dividing the district into three easily definable units (Fig. 1). Hunters were then asked to identify which of the three areas they harvested their deer in. Although area 1 is larger than the study area, (374 mi^2 compared to 190 mi^2), the majority of the additional area is very low density mule deer range. Also, some of the study area population range outside of the study area during the hunting season.

Major cover types within the study area mapped by Econ Inc for the Bureau of Land Management in 1979, were used for this study with two minor modifications. The "grassland" type was divided into two subtypes: the sod-forming grasses characterizing gently rolling prairie, and bunchgrasses dominating the steeper slopes and narrow ridgetops. Also, the closed canopy and open canopy broadleaf tree types were combined into one group. Each of the native cover types was sampled to provide a description of the vegetation. The area was arbitrarily divided into 10 blocks of approximately equal size. The largest area of each

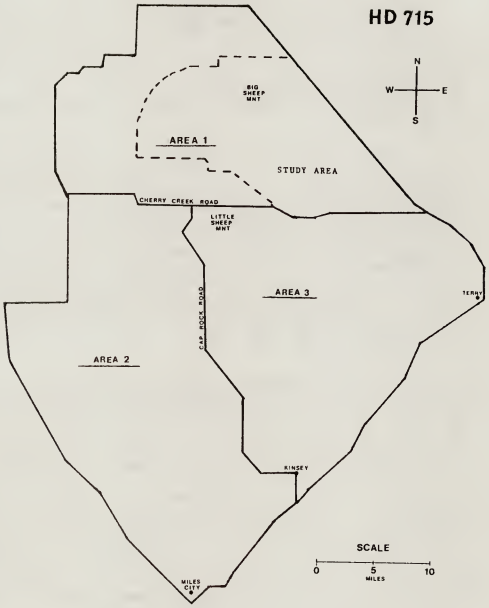

Figure 1. A map of deer hunting district 715 illustrating how the district was divided for determination of harvest distribution. The location of the study area is also shown.

cover type within each of the 10 blocks was identified on the type map. A sample site was selected in each of these areas, using aerial photographs, based on homogeneity and mapping unit descriptions described by Econ Inc. (1979). At each sample site 40, 2x5 dm quadrats were spaced at 5-m intervals along the transect line. Frequency of each plant species encountered within the transect was recorded. In addition, percent cover of grass, forbs, shrubs, litter, and bare ground were determined along the same transect. This was accomplished using 20 quadrats per transect spaced at 10 meter intervals following procedures described by Daubenmire (1959). Transects in narrow, linear cover types were arranged at an angle of 45^{o} to the direction of the drainage to include samples from the edge. When an outer edge of the type was encountered, another line was established at 90^{o} from the previous line and still at 45^{o} to the drainage until 200 meters were covered. All other cover types were sampled along a straight 200 m line. A Shannon-Weiner diversity index (Krebs 1978 p. 455) was calculated for each transect and then averaged over all transects of each cover type. Plant taxonomy followed Hitchcock and Cronquist (1981).

RESULTS

Cover Type Description

Eight cover types were identified on the study area: 1) sodgrass, 2) bunchgrass, 3) sagebrush grassland, 4) badlands community complex, 5) mesic shrub, 6) broadleaf trees, 7) legume hayfields, and 8) small grains. A description of dominant species, diversity, and cover estimates for grass, forbs, shrubs, litter, and bare ground is found in Table 1.

The sodgrass type is dominated by western wheatgrass (Agropyron smithii) and needle-and-thread grass (Stipa comata). This type is characterized by flat to gently rolling terrain. In contrast, the bunchgrass is dominated by threadleaf sedge (Carex filifolia) and bluebunch wheatgrass (Agropyron spicatum). This type is found on moderately steep slopes and ridgetops.

The sagebrush grassland (xeric shrub grassland of Econ Inc. 1979) is dominated by western wheatgrass and silver sagebrush (Artemisia cana). This type is found in the lower portions of drainages and in a few scattered upland areas. The upland areas were sampled separately from those in the drainages but no significant differences were found in terms of cover or species composition. The sagebrush grassland is essentially a sodgrass type with a significant increase in shrub cover resulting primarily from silver sagebrush. Some of these stands occurring on major drainages also support widely scattered plains cottonwoods (Populus deltoides).

The badlands community complex is characterized by steep, rugged, sparsely vegetated terrain. Dominant species were bluebunch wheatgrass and snakeweed (Gutierrezia sarothrae). These

Table 1. Dominant species, Shannon-Wiener diversity index, and cover values for the six native cover types. Values are recorded as means ±95% confidence intervals.

	Cover Type					
	Sod-grass	Bunch-grass	Sage-Grassl.	Badland Complex	Mesic Shrub	Broad Leaf Trees
Dominants	Agsm-Stco	Cafi-Agsp	Agsm-Arca	Agsp-Xasa	Syoc-Popr	Frpe-Syoc-Popr
Diversity Index	2.15 ±.33	2.67 ±.13	2.51 ±.13	2.80 ±.33	2.48 ±.17	2.84 ±.11
% Grass	71.1 ±2.8	45.4 ±3.5	57.2 ±3.5	5.0 ±1.4	49.7 ±4.9	25.2 ±4.2
% Forbs	5.5 ±1.3	8.0 ±1.3	4.6 ±0.8	6.8 ±1.3	11.8 ±1.9	15.6 ±2.8
% Shrubs	0.2 ±0.2	1.5 ±1.1	19.9 ±3.4	8.7 ±2.6	48.4 ±4.3	23.8 ±3.8
% Litter	88.8 ±1.8	60.9 ±4.1	85.2 ±2.9	15.0 ±3.2	95.1 ±1.7	92.6 ±2.0
% Bare Grd.	7.2 ±1.2	27.5 ±3.4	8.9 ±2.2	72.8 ±3.7	0.8 ±0.5	3.0 ±1.3

"badlands" had species diversity equal to that of the broadleaf tree cover type (Table 2). The badlands also have small inclusions of each of the other native cover types. (These inclusions were not sampled as part of the badlands complex). Consequently, as a mapping unit, the badlands represent the most diverse cover type on the study area.

The mesic shrub type is located in long, narrow drainages. This type occurs in areas with a more favorable moisture regime than the sagebrush grassland and less favorable moisture regime than the broadleaf tree type (Severson 1981). This type is dominated by snowberry (Symphoricarpos occidentalis) and Kentucky bluegrass (Poa pratensis). The broadleaf tree cover type was similar to the mesic shrub type except that they are dominated by green ash (Fraxinus pennsylvanica). Chokecherry (Prunus virginiana) is subdominant. The broadleaf tree type is essentially a mesic shrub type with tree overstory. Overstory canopy, as measured with a densiometer, averaged 88%.

The two cropland types, legume hayfields and small grains, are both dryland crops. Legume hayfields are composed of alfalfa (Medicago sativa) or yellow sweetclover (Melilotus officinalis)

from which a single crop is harvested, usually in July. Upland fields had very little growth after harvest, but fields located in drainages received extra moisture from summer thundershowers in the form of runoff. These fields stayed green until autumn frosts. Legume hay fields were generally less than 20 hectares (50 acres) in size. Small grain crops were predominately winter wheat with some spring wheat, barley, and oats. They were typically larger than hayfields and may be over 260 hectares (640 acres) but were normally about half that size.

Habitat Use

Seasonal habitat use patterns for radio-equipped deer are summarized in Table 2. The data indicate the importance of the badlands to mule deer. What the data do not show however, is that much of the bunchgrass and broadleaf tree use during late fall, winter, and early spring, occurred in areas within or adjacent to the badlands.

Table 2. Habitat use patterns of radio equipped mule and white-tailed deer from June 1983 to June 1984. All values are recorded as a percent of the total observation for each period.

	Mule Deer				White-tailed Deer			
	Mar-May	Jun-Aug	Sep-Nov	Dec-Feb	Mar-May	Jun-Aug	Sep-Nov	Dec-Feb
Sodgrass	1	5	4	1	8	19	20	8
Bunchgrass	30	2	9	21	14	3	6	17
Sage-Grassl.	7	20	20	6	1	4	1	4
Badlands	30	29	34	48	0	0	1	1
Mesic shrub	5	6	7	0	7	10	14	6
Broadl. Tree	27	37	24	24	63	56	44	53
Hayfield	0	1	2	0	5	4	2	2
Small grain	0	0	0	0	2	4	12	9
Total No. of Observations	446	199	230	274	156	72	95	108

The use of sagebrush grassland increased during summer and fall. However, those areas which received the most use were adjacent to legume hayfields. The majority of the radio locations reported in Table 2 were from daylight hours. Sagebrush grasslands adjacent to hayfields were used as bedding sites during the day, with the deer moving into the hayfields after dark. Each night radioed deer moved up to 2 km (1.25 mi) from bedding sites to feed in alfalfa fields. Sagebrush grasslands not associated with hayfields received only minimal use. The importance of legume hayfields is further illustrated by data collected during spotlight surveys of mule and white-tailed deer in five alfalfa fields (Fig. 2). Total area of the five fields was 43 hectares (107 acres). At the peak of alfalfa use in early

September, deer densities reached 4.3/hectare (1.7 acre). The decreased number of deer observed on September 30 was likely due to a cold rain which fell that night.

White-tailed deer habitat use patterns (Table 2) illustrated the importance of broadleaf tree cover to this species. More than half of the deer were located in this cover type in every season except autumn when deer moved into harvested grain fields to feed. Grasslands were also important. The shift from sodgrass to bunchgrass reflected a shift away from more level areas which are suitable for small grain production. The areas most likely to contain white-tailed deer were areas with broadleaf tree cover adjacent to agricultural fields. Observations indicated that croplands are the determining factor in white-tail distribution from late summer through early winter and that broadleaf tree cover takes precedence from early winter to early summer.

Movements and Home Range

Most mule deer used distinct winter and summer ranges separated by 2-33 Km (1.25 to 20.5 mi.) The summer ranges were generally lower in elevation than winter ranges. Only 5 of 32 radio-equipped mule deer remained on essentially the same area throughout the year. Year-long home ranges for two of these adult females were 4.1 km^2 (1.6 mi^2) and 3.6 km^2 (1.4 mi^2). No calculations were made for the other three deer with this pattern because 2 of the radios failed and 1 fell off. Three representative adult female mule deer with distinct seasonal home ranges were selected for additional calculations. Summer home ranges were from 0.62 to 0.91 km^2 (0.24 to 0.35 mi^2) in size. Winter home ranges were from 1.42 to 1.71 km^2 (0.55 to 0.66 mi^2) in size. These areas are much smaller than those reported earlier by Wood (1983). However, data for the 1983 calculations included deer with distinct seasonal ranges and points from both winter and summer ranges.

Dispersal has been defined by Bunnell and Harestad (1983) as a movement outside of the home range that exhibits no predictable return. Based on this definition, several yearling mule deer dispersed during the summer of 1983. Twelve of 16 (75%) of all yearling males dispersed off the study area. The longest dispersal documented was 140 km (87 mi). Only 1 of 16 yearling females dispersed 10 km (6 mi) but remained on the study area.

The majority of radio-equipped white-tailed deer also used different seasonal ranges. However, there was a great deal of overlap between seasons and there was no clear definition between winter and summer ranges. Rather there were several seasonal ranges used throughout the year. All four of the yearling male whitetails dispersed. The greatest recorded distance was 75 km (46 mi). One yearling female dispersed 59 km (37 mi).

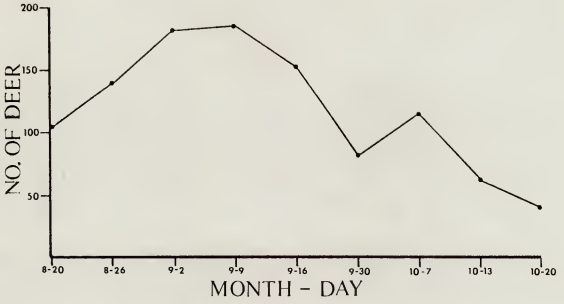

Figure 2. Total number of deer counted each week during spotlight counts of five alfalfa fields.

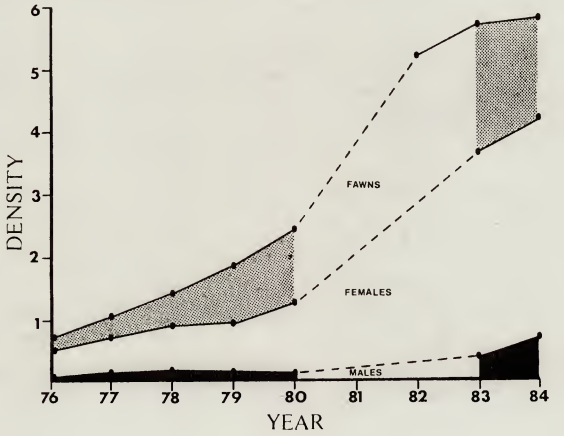

Figure 3. Late winter density estimates for mule deer on the Terry study area. No late winter surveys were flown in 1981 or 1982. The 1982 estimate represents a best guess based on the number of adults present during the autumn 1982 survey. Density is number per $mi.^2$

Population Dynamics

A total of 75 mule deer (57 females and 18 males) was captured and marked in January and February, 1984, providing a marked sample of 122 mule deer in mid-winter. April population estimates indicate that the mule deer population has stabilized at approximately 1100 mule deer (Fig. 3). This represents a very sudden stabilization of population growth after several years of rapid increase. Population growth rate expressed as a compounded annual interest rate (Connolly 1981 p. 301) averaged 34% from 1976 to 1983.

The mule deer density estimates in Figure 3 represent an average density for the entire study area. This is not an accurate reflection of actual deer density due to the large portion of unoccupied range. Density estimates for winter range were calculated using only that portion of the study area occupied during the January aerial survey. The area of occupied winter range was 192 km^2 (74 mi^2) and resulted in a winter density estimate of 5.7/km^2 (14.8/mi^2). This still gives no indication of the discontinuous nature of the winter range. Density of the Plenty Creek herd, one of the largest on the study area, was estimated at 31/km^2 (81/mi^2) during winter.

A total of 12 white-tailed deer (11 females and 1 male) were marked in 1984, providing a marked sample of 26 animals. However, because they are so widely distributed, may only be seen 3 or 4 times per year, and move such large distances throughout the year (both on and off the survey area), sample sizes for Lincoln index calculations were based on a marked sample of 21 resident animals. The April 1984 population estimate was 300 white-tailed deer compared to 330 for 1983 (Wood 1983).

Age structures for mule and white-tailed deer populations in early winter, are illustrated in Figure 4. Estimates are derived from data for 1983 and 1984. Mule deer estimates are derived from trapping data and early winter aerial survey data. White-tailed deer estimates were derived from trapping data and hunter harvest data. Consequently, estimates for whitetails are very likely to be biased by hunter selectivity, especially in the male segment. The low percentage of 2.5 year-old mule deer females was the same in both 1983 and 1984. If there were fewer deer in the 2.5 year age class in 1983, that should have been reflected in the 3.5 year age class data for 1984, which it is not. Consequently, that lower percentage of deer in the 2.5 year age class is probably a result of inaccurate age estimates using the tooth replacement and wear technique.

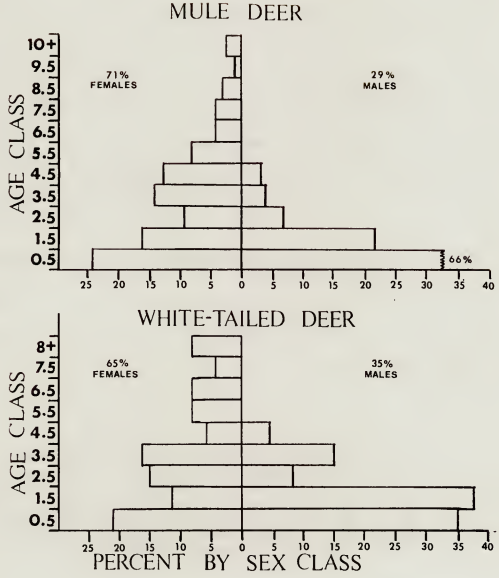

Figure 4. Sex and age structure of mule and white-tailed deer on the Terry study area during January 1983 and 1984.

Observability

Observability estimates for marked mule and white-tailed deer during aerial survey flights are summarized in Table 3. Estimates for mule deer during the March 1983 late winter survey were more similar to the January 1984 early winter survey than to the April 1984 late winter survey. This was largely due to a shift in distribution from winter to spring ranges prior to the 1984 late winter survey. Average herd size between the 1983 and 1984 late winter periods was not significantly different ($t=1.26$, $p.>05$). A light snow cover during one flight in March 1983 also helped. Observabilities were similar on March 1983 and January 1984 because conditions were similar in terms of snow cover and deer distribution. Both surveys were begun with about 5 to 7.5 cm (2-3 in) snow cover which aided observability. During the middle of the survey, snow cover was patchy, providing extremely difficult observation conditions. Snow cover was gone through the last part of each survey. Observability in this habitat can be much higher. During a single flight to locate radio-equipped deer in February 1983 with a 20 cm (8 in) snow cover, 79% of all the marked mule deer and 86 % of all marked whitetails were observed.

Table 3. Observability estimates for marked deer during aerial survey flights.

Survey Date	Mule Deer	White-tails
March 1983	65	No Estimate
July 1983	47	50
October 1983	51	53
January 1984	65	54
April 1984	58	67

Neckbanded deer could not be located regularly enough to determine season home range use or exactly how many were on the area during a survey flight. However, most were located frequently enough to determine survivability. From January 1983 to January 1984, the status of 56 of 58 mule deer females and 16 of 18 white-tailed deer females was known. The status of only 12 of 23 mule deer males and none of 4 white-tailed deer males was known.

Mortality Rates

Annual and seasonal estimates of mortality rates for mule deer are summarized in Table 4. Mortality rates, fawn:doe ratios, and population growth illustrated by Figure 3, indicate that population size has stabilized due to increasing rates of mortality both in and out of the hunting season. From 1976 to 1983, fawns made up an average of 37% of the spring population. As mentioned previously, the population grew at a rate of 34%

over that same period. Although data are not directly comparable, they do indicate that mortality rates have increased substantially in recent years.

Table 4. Annual and season mortality rates for mule deer from June 1983 to June 1984.

	JUNE 83-JUNE 84	JUNE 83-SEPT 83	OCT 83-NOV 83	DEC 83-JAN 84
ADULT FEMALE	12-23	5-10	7-12	0-1
ADULT MALE	57-61	0	57-61	0
FAWNS	?	?	13	29-31

Harvest Statistics and Trends

During 1983 deer hunting season, 200 "B" permits were issued for antlerless deer of either species on hunting district 715. Ninety-one percent of the hunters issued these permits were contacted to determine harvest rate and distribution: 75% actually hunted and of those, 83% were successful. Total antlerless mule deer harvest (A and B tags) estimated in the statewide deer harvest survey was reported at 198. Thirty-eight to 40 percent of these were taken from area 1 (Fig. 1). Population estimates indicated that 153 antlerless and 206 antlered mule deer were legally harvested from area 1. For the antlerless segment, the difference between these estimates amounts to 99% of the reported legal harvest. The fact that area 1 is larger than the study area would tend to make this estimate conservative, as reflected in the estimates for antlered males. Even allowing for a 10% increase in harvest estimates and a 10% decrease in population estimates due to sampling error, and a natural mortality rate of 10% (Table 4) (even though no natural mortality was observed during the hunting season), the difference still represents 46% of the legal harvest.

All these data conservatively indicate a very high rate of crippling and/or illegal kill on the study area. Such high rates are not unprecedented. Robinette (1977) reported an average crippling/illegal kill rate of 35% for mule deer in Utah, with the rate for fawns reaching 100% of the legal harvest during several years of either sex hunting. Poor condition and small fawn size were both reported to influence this rate. In found no direct evidence of high crippling or other mortality from either general observations or from survival of radio-collared and neckbanded deer during fall.

There was some evidence of a nonrandom distribution of hunter harvest over the hunting district, but the relationship was not statistically significant.

The distribution of harvest among male mule deer is sum-

marized in Table 5. These data indicate intense hunter selection for larger males. This selection is probably one of the major reasons for the age distribution of male mule deer illustrated in Figure 4. The effect of this harvest is also reflected in antler size. Average antler measurements for mature male mule deer harvested in 1982 and 1983 are: number of points - 3.3; maximum beam diameter at the base - 2.46 cm (0.9 in); and main beam length - 37.5 cm (14.8 in). When only 34% of the antlered males are mature bucks, 50% of which were spikes the previous year, and mature males are at a density of 1/3.3 km^2 (1/1.4 mi^2), it becomes very difficult for hunters to find large male mule deer.

Table 5. A summary of population composition, harvest composition, and hunting season mortality rates (using change-in-radio formulas) for adult male mule deer. All values are recorded as percentages.

	Preseason Classification	Harvest Composition	Post-season Classif.	Mortality Rates
Spikes*	25	7	47	15
Other yearling	40	42	30	87
Mature	35	51	23	62

*Spikes=yearling males with at least 1 unbroached antler, Other Yearlings=yearling male with 2 or more points for each antler, Mature=all males 2 years and older.

The relationship between mule deer density, total harvest, and fawn recruitment is illustrated in Figure 5. The mule deer density figure is the same as in Figure 3. Fawn recruitment is expressed as the percent of the total spring population which were fawns. The harvest estimates were compiled from MDFWP harvest data. Because hunting district boundaries changed over this time period, several district estimates were combined to provide a harvest estimate from a constant geographic area. This area is bounded by major highways beginning at Miles City then northwest to Jordan, east to Circle, southeast to Glendive, and southwest to Miles City. The 1983 deer hunting districts included were 715, 730, and 731. Figure 5 illustrates that harvests have been increasing in the same general pattern as the mule deer population from 1977 to 1982. Nearly two times as many antlerless deer permits are proposed for 1984 than were sold in 1983. If natural mortality rates do not change from those of the past year, the 1984 harvest should initiate a population decline.

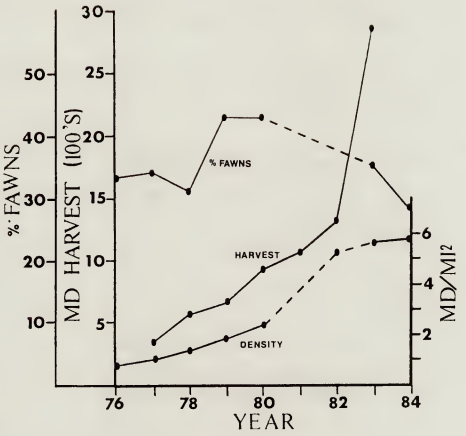

Figure 5. Trends in mule deer density, harvest, and spring recruitment of fawns from 1976 to 1984. Fawn recruitment is expressed as the percent of the total spring population composed of fawns.

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Prepared by Allan K. Wood

STUDY NO. BG-2.0 JOB NO. 1

JOB TITLE: Population ecology and habitat relationships of white-tailed deer in coniferous forest habitat in northwestern Montana.

ABSTRACT:

Studies to evaluate factors affecting populations of white-tailed deer in the Swan Valley and Tally Lake area were completed during 1983-84. Data collected at the lower Swan Valley checking station included information on the harvest, hunting and harvest distribution, age structure, of deer and their weights and body measurements. Movements of 22 radio-collared deer were monitored through November 1983 to delineate summer home ranges on the Tally Lake area. The major emphasis during this report period was on compilation and analysis of information gathered during prior years.

JOB OBJECTIVES:

1. To determine basic biological and ecological parameters of white-tailed deer populations associated with coniferous forest habitats in northwestern Montana;

2. To relate those basic parameters to (a) characteristics of individual habitats or environments and (b) specific potential limiting factors associated with individual populations and habitats, including nutrition, other wild ungulates, logging and associated forest management practices, subdivisions and associated human activity, weather, and hunting;

3. To further develop and test hypotheses relating to deer-habitat interactions and population regulation; and

4. To develop new methods, criteria, and guidelines for deer management, generally, and specifically for coniferous forest habitats.

INTRODUCTION

The white-tailed deer is the most abundant and widely distributed big game species in northwestern Montana. Its distribution is closely associated with the mature coniferous forest. Recent trends have indicted reduced populations, concurrent with the development of large areas of deer habitat for other values.

Montana Statewide Deer Research included a study to evaluate factors affecting white-tailed deer in the Swan Valley. That

area long has been an important deer range and is representative of a major ecological type in which white-tailed deer occur. The study has emphasized the collection of information basic to the distribution, movements, habitat use, and population dynamics.

The Northwest Montana White-tailed Deer Study was expanded during 1981-82 to include a study of white-tailed deer in the vicinity of Tally Lake. The emphasis of this study is similar to that in the Swan Valley.

STUDY AREA

The Swan River Valley occurs in southeastern Lake and northeastern Missoula counties. The valley lies between the Swan Range and the Mission Mountains and extends from the Swan-Clearwater Divide north, approximately 40 miles, to Swan Lake (Fig. 1). The primary winter range lies between Goat Creek and Condon. Condon is approximately 70 miles northeast of Missoula and 65 miles southeast of Kalispell.

Hildebrand (1971) and Antos (1977) described the Swan Valley. The history of the deer population- and summaries of early studies were presented by Weckwerth (1958), Hildebrand (1971), and Mundinger (1976).

Tally Lake is 10 miles west of Whitefish and 17 miles northwest of Kalispell. Tally Lake is a principle feature within an unnamed range of hills and low elevation mountains that extend from U.S. Highway 2, approximately 10 miles west of Kalispell, north and northwest to the Tobacco Valley, near Eureka. Within that range, the study area has been arbitrarily defined by the boundaries of Martin Creek on the north, and from the head of McMannamy Draw northwest to Ingalls Mountain and thence north to Fox and Grouse Mountains. Within the study area, Martin Creek, Good Creek, and Logan Creek, which flows through Tally Lake, are prominent tributaries of the Stillwater River. Sheppard Creek and Griffin Creek are prominent tributaries to Logan Creek. Star Meadows occurs at the confluence of the three creeks.

White-tailed deer winter along the eastern fringe of the range of hills, from Pilot Knob south to Ashley Creek. The study is concerned with this population of animals, and especially the segment that winters in the vicinity of the Ray Kuhns Wildlife Management Area (RKWMA) (Fig. 2). That Wildlife Management area was formed by the merger of lands acquired by the Montana Department Fish, Wildlife and Parks from the estate of Ray Kuhns with the former Bowser Lake Wildlife Management Area. RKWMA now includes 1,512 acres of deeded land and 79 acres of land which is leased from the Montana Department of State Lands.

Bowser Lake is 10 miles northwest of Kalispell. The RKWMA is accessed by the Farm to Market Road (Flathead County Road 424). Principle features of the area include the Stillwater River, Pete Ridge, the Lost Creek.

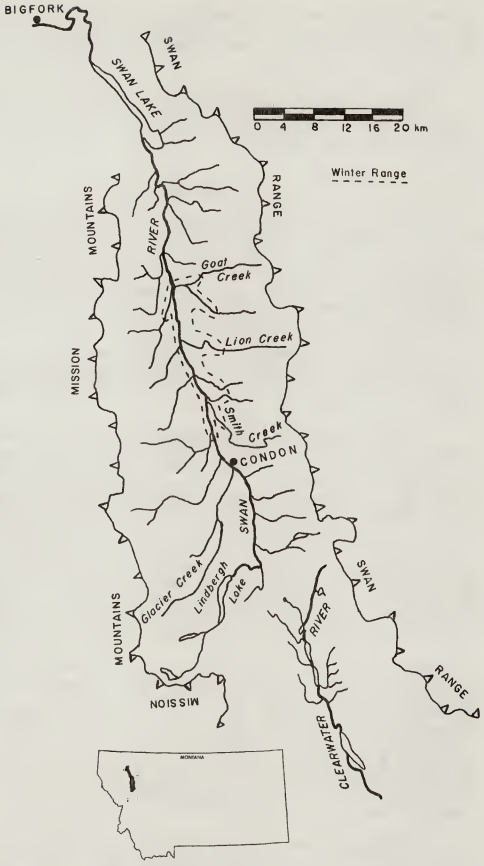

Figure 1. Map of the Swan River Valley Study Area.

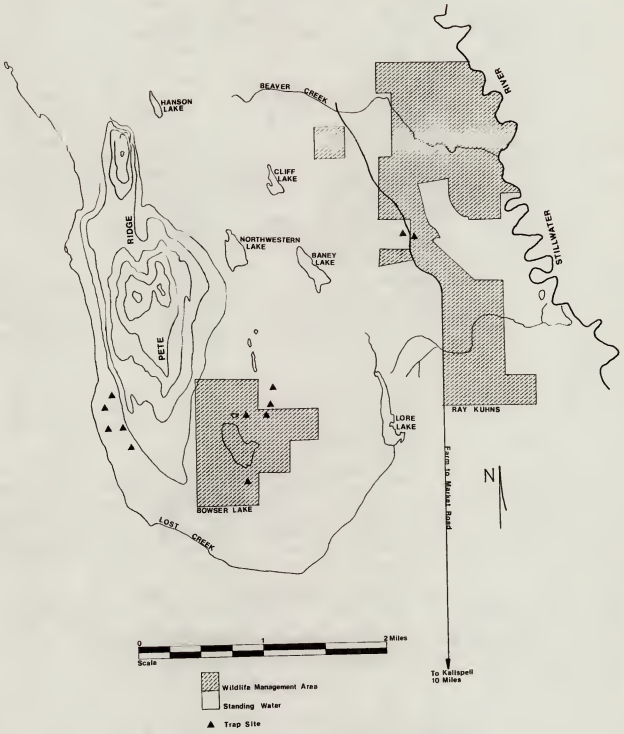

Figure 2. Map of the Bowser-Tally Lakes study area.

The RKWMA is occupied by mature, coniferous forest. The Pseudotsuga menziesii/Symphoricarpos albus H.T. (Pfister et al. 1977) is the major habitat type on the area. Douglas fir (Pseudotsuga menziesii) is the dominant species in a mixed overstory that also includes western larch (Larix occidentalis), lodgepole pine (Pinus contorta), and a minor component of ponderosa pine (Pinus ponderosa). The Picea/Clintonia uniflora H.T., in which spruce (Picea spp.) is dominant, occurs along the Stillwater River and as minor inclusions near Bowser Lake. Major species in the forest understory include common juniper (Juniperis communis), snowberry (Symphoricarpos albus), pine grass (Calamagrostis rubescens), white spirea (Spiraea betulifolia), kinnikinnic (Arctostaphylos uva-ursi), and Oregon grape (Berberis repens). The understory also includes sparse amounts of serviceberry (Amelanchier alnifolia), mountain maple (Acer glabrum), and huckleberry (Vaccinium spp.). Arboreal lichens (Allectoria spp.) are common.

The climate in the vicinity of the RKWMA is milder than that which is typical of northwestern Montana. Average daily temperatures range between -7 and 19 C, and recorded extremes have been -37 and 38 C. The average annual precipitation is 42 cm, most of which occurs as snow. The average growing season is 105 days.

Methods

Methods employed in the study were previously described. The primary field effort occurred on the Tally Lake area during the current report period.

A part-time checking station was operated in the Swan Valley during the 1983 hunting season. Hunters were interviewed to determine hunter origin, drainages hunted, and locations of animals observed and harvested. Ages of harvested animals were determined (Severinghaus 1949; Robinette et al. 1957; Quimby and Gaab 1957; Gilbert 1966). Weights and body measurements of white-tailed deer also were collected.

A sample of 29 telemetry-equipped deer from prior years was available for study on the Tally Lake area. Of those, 22 were intensively monitored to delineate individual summer home ranges. Radio-collared animals were previously relocated, both from the ground and from fixed-wing aerial surveys.

Results and Discussion

The 1983 hunting season in the Swan Valley spanned 5 weeks. This included 8 days of either-sex and 4 weeks of males-only hunting. Hunting season statistics, as determined from the lower Swan Check Station and the Montana big game questionnaire are presented for the 1975-83 hunting seasons in Table 1. These data indicate an average annual harvest of 703± S.E. 125 white-tailed deer over the 9-year period, and a preponderance of adult males in the harvest. The questionnaire and the check station data

Table 1. Summary of 1975-1982 hunting seasons in the Swan Valley.

	1975	1976	1977	1978	1979	1980	1981	1982	1983
Season Format	10/19-	10/24-	10/23-	10/22-	10/21-	10/19-	10/25-	10/24-	10/25-
Either Sex	11/9	10/31	10/30	10/29	10/28	10/26	11/1	10/31	11/1
Males Only	11/10-11/23	11/1-11/28	10/31-11/27	10/30-11/26	10/29-11/25	10/27-11/30	11/2-11/29	11/1-11/28	11/2-11/27
Hunter Days									
Questionnaire	40/511	33,606	39,691	31,653	30,914	28,244	23,550	27,304	26,267
Check Station	2,750	3,317	3,239	3,016	2,640	2,959	2,591	3,064	2,516
White-tailed Deer Harvest									
Questionnaire	635	523	736	625	612	746	668	883	897
Check Station	98	104	154	124	150	208	172	188	183
Mule Deer Harvest									
Questionnaire	70	94	86	69	96	128	112	176	129
Check Station	13	15	24	12	12	28	14	20	8
Elk Harvest									
Questionnaire	293	125	222	135	123	155	112	78	97
Check Station	51	29	39	29	29	35	37	40	20
White-tail, % adult males									
Questionnaire	55	74	79	79	67	71	72	80	77
Check Station	49	66	68	66	41	53	55	57	74
Deer Hunters									
Questionnaire	4,501	3,673	4,323	3,779	3,647	3,704	2,536	2,991	2,619
Deer Hunter Success									
Questionnaire	17	17	20	18	20	24	31	35	39

both indicate an increasing trend in the white-tailed deer harvest.

The sex and age composition of the 1983 deer harvest is presented in Table 2. These data generally are consistent with age structures determined in prior years (Mundinger 1981; Mundinger and Riley 1983).

Table 2. Percent composition, by age-class, of the 1983 white-tailed deer harvest in the Swan Valley.

Age Class	Female	Male	Total
1/2	19	6	9
1-1/2	38	42	41
2-1/2	24	29	29
3-1/2	11	7	8
4-1/2	5	8	8
5-1/2		3	3
6-1/2		2	2
7-1/2		1	1
8-1/2		1	1
9-1/2	3		1
Sample	37	143	180

Hog-dressed weights and body measurements (Table 3), obtained at the check station, indicated that white-tailed deer in the Swan Valley are larger than average white-tailed deer in Montana (Mackie 1964). These data also suggest that females continued to increase in size and weight through at least 3-1/2 years, while males increase through 5-1/2 years.

Summer home ranges were delineated for 15 telemetry-equipped adult does on the Tally Lake area in 1982. During 1983, summer home ranges were delineated for 22 animals, 12 of which were included in the 1982 sample. The average size of the summer home ranges was 462 acres. Two general patterns of summer range use, with respect to size and configuration, were apparent.

Nine deer occupied large home ranges ($\bar{X}$ = 593 acres) that characteristically were associated with extensive riparian feature and contiguous, steep, timbered ridges. Although individual locations of these deer were dispersed throughout their respective home ranges, early and late summer locations occurred on the ridges, and mid-summer locations occurred in the riparian feature.

Thirteen deer occupied summer home ranges that were significantly smaller ($\bar{X}$ = 316 acres, $P < 0.001$). Generally, these home ranges were associated with an interspersion of small riparian features and timbered upland in gentle terrain. An activity center, apparent from a cluster of locations, was the distinguishing characteristic which separated the smaller from the

larger home ranges. The average activity center was 63 acres, which represented an average of 22% of the respective home range. Yet, for those deer an average of 75% of the locations were within an activity center. Typically, the activity center was associated with one or more small riparian features. This pattern of summer range use was similar to that described for white-tailed deer in the upper Swan River Valley (Leach 1982).

Table 3. Average hog-dressed weights and body measurements of white-tailed deer harvested in the Swan Valley, Montana 1975-82.

Sex	Age	Wgt. (lbs)	Lgt. (cm)	Hgt. (cm)	H.ft. (cm)	Sample Size
Females	1/2	57.9	114.5	78.0	40.8	60
	1-1/2	95.4*	134.3*	89.2*	45.5*	72
	2-1/2	103.5*	140.1*	91.3*	46.2*	67
	3-1/2	111.7*	143.5*	92.3	47.0*	25
	4-1/2	114.2	143.9	92.9	46.8	19
	5-1/2	109.4	140.4	94.3	45.8	8
	6-1/2	113.0	143.8	93.7	46.4	12
	7-1/2	108.0	141.0	92.8	46.6	4
	8-1/2	118.2	144.3	92.9	46.1	8
	9-1/2	104.0	147.5	94.5	47.0	1
	10-1/2	116.5	147.5	94.5	47.5	2
	11-1/2	110.0	139.0	96.5	47.8	2
	12-1/2	101.5	147.8	94.8	45.5	2
	13-1/2	94.0	145.5	88.5	46.0	1
	14-1/2	120.0	142.0	94.0	46.0	1
Males	1/2	63.0	116.5	80.6	42.0	61
	1-1/2	111.7*	140.9*	93.8*	47.6*	249
	2-1/2	142.0*	150.6*	99.3*	49.4*	115
	3-1/2	159.7*	157.8*	102.1*	49.6	51
	4-1/2	175.5*	160.5	102.0	49.8	35
	5-1/2	185.4*	163.8**	103.6**	50.2	25
	6-1/2	184.3	165.1	104.6	49.8	13
	7-1/2	183.9	164.3	105.4	49.9	14
	8-1/2	187.3	166.6	102.3	50.5	6
	9-1/2	194.7	165.8	104.0	49.8	3
	10-1/2	179.5	160.3	102.6	48.5	4
	11-1/2	170.0	177.5	103.5	50.0	1

* Significantly larger, $P < 0.05$, than preceding number in the column

** 5-1/2 males larger than 3-1/2 males.

Three individual deer differed markedly from this pattern. One deer occupied a 234-acre summer range and a distinct fall range of 268 acres. The minimum distance between these ranges was 1.5 miles. This deer was unique in that the fall home range was not on the migration route between summer and winter home ranges and apparently had not been used during spring.

One deer occurred in a 27-acre activity center. The extreme locations that defined the large home range may have been responses to disturbance associated with both an active timber sale on one margin of the home range, and continued heavy truck traffic on the road that bisected the home range.

One deer occupied a summer home range of 841 acres within which 27 or 34 locations occurred in a 212-acre area. This deer was associated with an extensive area of young, second growth forest, within which two residual stands of mature forest recently were clearcut. The 212 acre area included a small stand of mature forest and two very dense stands of saplings. The extreme locations were in mature forest.

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Prepared by John G. Mundinger

STUDY NO. BG-2.0 JOB NO. 3

JOB TITLE: Population ecology and habitat relationships of white-tailed deer in river bottom habitat in eastern Montana.

ABSTRACT:

Studies to evaluate factors affecting populations of white-tailed deer on islands and floodplain of the lower Yellowstone River were continued in 1983-84. Intensive research was continued in 3 units between Glendive and Sidney, Montana, while general monitoring was continued on the entire river bottom. Fall aerial classification indicated a fawn:adult female ratio of 68:100 (143:100 producing females). Fifty-one percent of the adult females (1.5+), which included 24 percent of those older than yearlings, did not produce or successfully rear fawns in 1983. Estimated neonatal fawn mortality was 21, 27, 28 and 51 percent during 1980, 1981, 1982 and 1983, respectively. Hunting accounted for 80 percent of annual mortality of animals older than 0.5 years with 22 percent of hunting mortality attributable to crippling. Thirty-one percent of the early fall population was removed by hunting in 1983. Between-year population increases for fall were 35, 19 and 7 percent, respectively. Spring aerial census surveys indicated an 18 percent increase in deer numbers at Elk Island and no increase at Intake from 1983 to 1984. Evaluation of habitat relationships was also continued.

JOB OBJECTIVES:

1. To determine basic biological and ecological parameters of white-tailed deer populations associated with river bottom habitat in eastern Montana;

2. To relate these basic population parameters to (a) characteristics of individual habitats or environments and (b) specific potential limiting factors associated with individual populations and habitats, including nutrition, agriculture and associated farming practices, domestic livestock and associated grazing/range management practices, weather, disease and hunting;

3. To further develop and test hypotheses relating to deer/habitat interactions and population regulation; and

4. To develop methods, criteria and guidelines for deer management, generally, and specifically for river bottom habitats.

INTRODUCTION

In 1980 a study of population ecology and habitat relationships of white-tailed deer was initiated on a representative stretch of the lower Yellowstone River (Dusek 1981). This report summarizes findings through spring 1984. Intensive research was continued on 3 segments of river bottom between Glendive and Sidney, Montana (Figure 1) while general monitoring was continued over the entire area.

Efforts during the report period emphasized monitoring of distribution, population trends, characteristics and dynamics and hunter harvests of white-tailed deer along the entire river bottom study area. Intensive studies included monitoring seasonal and daily patterns of distribution and habitat use and population size, structure and trends of deer on the Elk Island, Seven Sisters and Intake segments. Trends in fawn production and survival, adult longevity, sex/age specific mortality and hunter harvest patterns and rates were also monitored during the report period. In cooperation with regional management personnel, the effort initiated in the prairie/agricultural habitat, west of the river bottom near Richey, Montana, during winter 1982-83 (Dusek 1983) was continued on a limited basis.

STUDY AREAS

The principal study area (Figure 1) includes approximately 53 miles of floodplain and islands of the lower Yellowstone crossing portions of Dawson, Wibaux and Richland Counties. The northern edge of the study area lies approximately 20 miles from the confluence of the Yellowstone and Missouri Rivers. Upstream and downstream study area limits include the Interstate-94 Bridge at Glendive and the MDU Bridge just south of Sidney on state highway 23, respectively. Areas of intensive study, physiography, soils and land use practices have been described previously (Dusek 1981). Vegetal composition and successional relationships of riparian communities have been described in detail by Boggs (1984). The prairie/agricultural study area on the Yellowstone-Missouri Divide described previously by Dusek (1983).

With the exception of December, weather conditions during the period of November 15, 1983 through March 31, 1984 were comparatively mild (Table 1). December 1983 with a weather severity index of 3,725 was the most severe since 1978.

METHODS

Procedures generally followed those of Dusek (1981, 1982, 1983). An additional 84 deer, including 77 new deer and 7 recaptures, were marked during winter 1983-84. Nineteen of the new deer and 4 of the recaptures were equipped or re-equipped with transmitter collars.

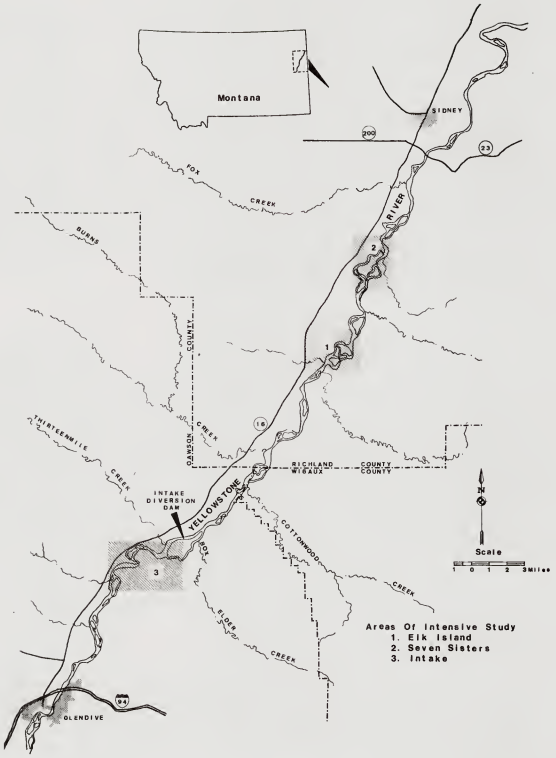

Figure 1. The lower Yellowstone River study area.

Table 1. Climatological data and weather severity indices for mid-November-March, Sidney, Montana .

Year	Days Below Freezing(F)[a]	Days Snow on Ground[b]	Total Precip. (in.)	Maximum Snow Depth (in.)	Severity Index[c]
1977-78	93	122	2.4	15	+17,835
1978-79	99	137	2.69	25	+24,028
1979-80	62	69	1.30	10	+ 1,565
1980-81	40	25	0.99	7	- 600
1981-82	72	113	3.92	19	+13,242
1982-83	44	80	2.19	7	+ 457
1983-84	64	67	1.81	7	+ 4,158
Average	68	88	2.19	13	+ 8,669

[a] Number of days on which the maximum daily temperature did not exceed 32 F.

[b] Number of days on which there was 1 or more inches of snow cover.

[c] After Picton and Knight (1969).

Trends in distribution and population size and structure were determined for the river bottom study area from a complete coverage aerial survey during early winter 1983-84 and from aerial surveys of the 3 survey units (Figure 1) during fall 1983 and spring 1984. Population estimates for the Elk Island and Intake study units were determined from 3 fixed-wing flights in each of the units during March and April 1984. A population estimate was made for the Elk Island unit in mid-February from a helicopter survey. Movements and distribution of radio-collared deer on the river bottom were monitored at 10-15 day intervals throughout the year from a fixed-wing aircraft. Field work pursuant to determining circadian patterns of movement and habitat use by deer at Elk Island and Intake (Herriges 1983) was completed during summer 1983 and winter 1983-84.

Trends in population size and structure in the prairie/agricultural habitat near Richey were determined from fixed-wing surveys during fall 1983 and spring 1984. Seven flights were made throughout the year to monitor movements and distribution of radio-collared deer.

Fifteen deer were collected from the 3 intensive study units (Figure 1) to determine trends in physical condition, reproduction and forage use. This sample was supplemented with data from road-kills and from deer succumbing to other types of mortality. Blood was taken from 16 dead animals and from 37 trapped animals to determine if levels of serum progesterone could be used to determine rates of pregnancy (Plotka et al. 1977).

RESULTS

Population Characteristics

Herd Composition, Production and Fawn Survival

Composition of the river bottom population by sex and age from aerial classification during fall, early winter and spring is shown in Table 2. The proportion of fawns in the pre-hunt (fall) population steadily declined from 1980-82, with a greater decline observed from 1982-83. Recruitment, or the proportion of the population consisting of fawns during early spring, followed a similar trend. The low proportion of fawns, observed in the population during spring 1984, as compared to early winter, may have been due to some fawns being classified as adults since spring surveys were made later than during previous years. The 15 percent fawn loss from winter to spring (Table 2) was not substantiated by comparative population estimates at Elk Island or by known mortality of individually marked fawns.

Table 2. Seasonal herd composition by sex and age of white-tailed deer on the lower Yellowstone River in hunting district 750.

Year	Number Classified	% Male 2.5+	% Male 1.5	% Female 1.5	% Fawn	Fawn: 100 Fem. 1.5+	Fawn: 100 Ad. 1.5+	Male: 100 Fem.
				Fall (Pre-hunt)				
1977-79	452	10[b]	--	44	46	108	87	23
1980	540	6	12	39	43	112	76	46
1981	334	5	11	43	41	96	69	39
1982	664	8	15	40	37	95	60	58
1983	316	8	14	46	32	68	46	47
				Early Winter				
				---Percent Adults---				
1980-81	687			55		45		81
1981-82	1,581			55		45		82
1982-83	1,089			56		44		78
1983-84	1,562			61		39		48
				Early Spring				
1981	425			55		45		81
1982	490			59		41		68
1983	563			58		42		73
1984	803			67		33		48

[a] Pre-hunt data for 1977-79 were from R-7 annual reports and yearly trends were reported previously (Dusek 1982)

[b] Yearling and older males were not separated in the sample of 1977-79.

Observed declines in fall fawn:doe ratios (Table 2), the ratio of fawns:female with fawns-at-heel during summer and early fall, and the proportion of adult females successfully rearing fawns fawns to fall together with an increase in the proportion of producing females with single fawns at heel (Table 3) all reflected a downward trend in net fawn production from 1980-83. This trend was not evident in pregnancy, ovulation, or fetal rates nor by other prenatal data (Table 4). The pooled 1982-83 data suggested a slight decline in ovulation and fetal rates. The in-utero data (Table 4) strongly suggested that females in the age classes of 2.5-5.5 years (3.5-6.5 at fawning) exhibited the greatest reproductive potential.

Table 3. Productivity of adult white-tailed deer females on the Yellowstone River 1980-1983.[a]

		Fawns:100 Producing Females	Percent Ad. Female Producing	Singles	Twins	Triplets
Sep-Oct	1980	154:100 (133)[b]	68	47[c]	51	2
July-Aug	1981	162:100 (101)	--	41	57	3
Sep-Oct	1981	154:100 (123)	60	51	43	6
July-Aug	1982	154:100 (96)	--	49	48	3
Sep-Oct	1982	143:100 (164)	60	58	41	1
July-Aug	1983	152:100 (135)	--	52	44	4
Sep-Oct	1983	143:100 (95)	49	57	43	--

[a] Sample obtained from Elk Island, Seven Sistens and Intake study areas.
[b] Producing female sample size in parentheses.
[c] Percent of producing females.

Table 4. Prenatal productivity of white-tailed deer on the lower Yellowstone from analysis of reproductive tracts of 53 females during winter and spring, 1982-83, and 1984.

	Percent Pregnant		Ovulation Index		Fertilization Rates(%)		Fetuses/ Preg.	Fem.	Multiple Births (%)	
Age	82-83	84	82-83	84	82-83	84	82-83	84	82-83	84
Class	(37)	(16)[a]	(21)	(11)	(21)	(11)	(29)	(12)	(29)	12
0.5	11	0	1.00	--	100	--	1.00	--	0	--
1.5	100	83	1.25	1.25	100	100	1.33	1.40	33	33
2.5-3.5	100	100	1.89	2.00	94	100	2.10	2.00	80	75
4.5-4.5	100	100	2.00	2.00	100	100	2.00	2.00	100	100
6.5+	100	100	2.40	2.50	75	80	1.83	2.00	83	100
Overall (1.5+)	100	92	1.90	1.82	89	95	1.79	1.75	67	67
Average	96		1.86		92		1.77		67	

[a] Sample size is in parentheses.

Fawning success was determined for 55 individually marked females (1.5+) during summer and early fall 1983 and compared with the combined data from 1980-82 (Table 5). With the exception of 5.5 year-olds, a smaller proportion all age classes of females older than yearlings was successful in rearing fawns during summer 1983. It appeared that neonatal mortality was the single greatest contributor to declining production from 1980-83. As determined from the relative abundance of individual age classes of females older than yearlings and the relative rate of fawn rearing success among marked deer (Table 5), 24 percent of does 2.5+ were unsuccessful. When best estimate fetal rates were adjusted to give a ratio of fetuses:all females (0.5 years and older) and compared with observed fawn:adult female ratios, calculated fawn mortality was 21, 27, 28 and 51 percent during 1980, 1981, 1982 and 1983, respectively. Fawn rearing success of 30 individually marked adult females or which 2 or more years of data were available appears in Table 6.

Table 5. Net productivity of adult female white-tailed deer on the lower Yellowstone during 1980-82 and 1983 as determined from observation of individually marked females from June through mid October.

Age Class	No. Females 80-82	No. Females 83	% Prod Fawns 80-82	% Prod Fawns 83	Fawns: 100 Prod Fem 80-82	Fawns: 100 Prod Fem 83	Fawns: 100 Females 80-82	Fawns: 100 Females 83
1.5*	13	8	8	12	100	100	8	12
2.5	12	9	67	56	137	160	92	89
3.5	17	10	94	80	162	129	153	90
4.5	7	12	100	92	186	173	186	158
5.5	9	8	100	100	167	166	167	166
6.5+	16	8	81	75	169	167	137	125

[e] Includes only those females known to have successfully produced one or more fawns to fall.

*Note - of 21 yearling females, from which reproductive status was determined from 1980-83, only 2 (10%) were successful producers.

Mortality and Survival

Hunting was the single largest contributor to mortality of deer older than 6 months of age during all years combined. Eighty percent of 46 documented deaths of radio-collared deer, not including those related to trapping, were attributable to hunting. Of the 37 hunting related mortalities, 8 (22%) resulted from crippling or hunters failing to find their kills.

Table 6. History of reproductive success of individually marked female white-tailed deer for which success was known for 2 or more consecutive years.

Serial Number	Estimate Age at Capture	Number of Fawns Produced 1980	1981	1982	1983
80-83*	6-1/2	2	2	2	2
80-06*	4-1/2	2	2	2	
80-08*	3-1/2	1	2	2	
80-10*	1/2	0	2		
80-12*	3-1/2	?	2	2	2
80-29*	1/2	0	1	2	
81-01*	1-1/2		1	2	2
81-04*	2-1/2		2	2	
81-07	1/2		?	0	1
81-12*	1/2		?	2	1
81-13*	2-1/2		1	2	2
81-18*	2-1/2		1	2	2
81-20	5-1/2		1	2	?
81-29*	6-1/2		1	0	0
81-30*	1-1/2		0	2	2
81-34*	1/2		0	1	0
81-37*	2-1/2		1	2	1
81-39*	1-1/2		2	2	1
81-41*	1/2		0	1	2
82-02*	1/2			0	2
82-13*	1/2			0	0
82-15*	3-1/2			2	2
82-23*	1/2			0	1
82-37	2-1/2			1	0
82-53*	2-1/2			1	2
82-56*	1/2			0	0
82-58*	2-1/2			2	2
82-75*	4-1/2			1	1
82-81*	1/2			0	0
82-90*	2-1/2			1	2

*Animal had been equipped with a transmitter.

Composition by sex, age, and year of whitetails harvested in the study area from 1980-83 appears in Table 7. Annual rates of harvest of the river bottom population and by sex and age class, as determined from change-in-ratio (Downing 1980) and rates of removal of individually marked deer are summarized in Table 8. The proportion of the population removed by hunting increased each year from 1980 to 1983 as did the relative proportions of fawns and adults removed. Adult males were most vulnerable to hunting mortality, whereas fawns were least vulnerable (Tables 2 and 8). However, 1983 was the only year since the study began in which the number of females exceeded the number of males in the checked log.

Population Trend

The estimated population on the study area increased from 3,283 deer during early fall 1980 to 5,799 during early fall 1983 (Figure 2). Between-year increases were approximately 35, 19, and 7 percent, respectively. The rate of harvest increased as the population increased. Additions to the population declined annually to 1983 (Table 2) when numbers added nearly equalled numbers removed by hunting (Figure 2).

Table 7. Percent composition by sex and age of 417 white-tailed deer harvested on the lower Yelowstone in hunting district 750, from check stations and jaw collections, 1980-1983.

	Females				Males				Total			
Age Class	80 (33)[a]	81 (30)	82 (42)	83 (65)	80 (43)	81 (79)	82 (71)	83 (54)	80 (76)	81 (109)	82 (113)	83 (119)
1/2	15	23	19	17	7	10	13	11	11	14	15	14
1-1/2	27	17	26	17	53	38	28	31	42	32	27	24
2-1/2	21	20	19	15	16	33	46	24	18	29	36	19
3-1/2	6	13	7	14	16	16	11	28	12	16	10	20
4-1/2	9	10	5	8	5	1	--	6	7	4	2	6
5-1/2	3	7	2	6	--	1	1	--	1	3	2	3
6-1/2	6	7	5	5	--	--	--	--	2	2	2	3
7-1/2	12	--	2	6	2	--	--	--	5	--	1	3
8-1/2	--	--	5	3	--	--	--	--	--	--	2	2
9-1/2	--	3	7	6	--	--	--	--	--	1	3	3
10-1/2	--	--	--	2	--	--	--	--	--	--	--	1
11-1/2	--	--	2	--	--	--	--	--	--	--	1	--
12-1/2	--	--	--	--	--	--	--	--	--	--	--	--
13-1/2	--	--	--	2	--	--	--	--	--	--	--	1
14-1/2	--	--	--	2	--	--	--	--	--	--	--	1

[a] Sample size is in parentheses.

Table 8. Harvest mortality of white-tailed deer on the lower Yellowstone by sex and age class as determined by analysis of population and harvest statistics, relative rates of removal of marked adults, and change-in-ratio formulas (see text).

Year	% Pop. Removed	% Adult Removed N=2[a]	% Fawns Removed	% Ad. Fem. Removed N=2	% Ad. Ma. Removed N=2
1980	11(6)[d]	17.5(9)	3(2)	16(9)	48(29)
1981	15(13)	21.5(19)	5(4)	11.5(7)	55.5(51)
1982	25(22)	34(30)	10(9)	21.5(30)	66(79)
1983	31(28)	39(35)	13(12)	30(36)	70(76)

[a] An average of two or more independent estimates.

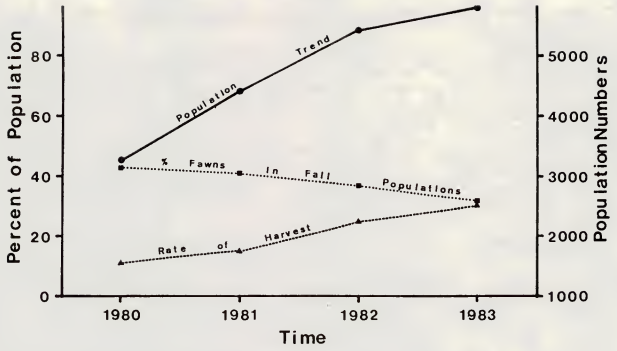

Figure 2. Trends in population numbers, fawns in the population, and annual harvests from 1980 to 1983.

Early spring population trends on the Elk Island and Intake study units are summarized in Table 9. The February helicopter survey and spring fixed-wing surveys at Elk Island indicated essentially no change in population numbers in that unit over winter. The population at Elk Island increased by 18 percent from 1983 to 1984, whereas the population at Intake remained at about the same in 1984 as 1983 (Table 9).

Habitat Use

Detailed analyses of white-tailed deer usage of river bottom habitats are in progress and will not be reported here.

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Prepared by Gary L. Dusek

Table 9. Population estimates of white-tailed deer on 2 study units on the lower Yellowstone River using a Lincoln index and aerial survey data.[a]

Elk Island Study Unit							Intake Study Unit						
Sampling Period	Air-craft	Obs.[b] Index	Prop.[c] Mkd.	Est. w/0.95 Confid. Interval Pt. Est.		CL	Sampling Period	Air-craft	Obs. Index	Prop. Mkd.	Est. w/ 0.95 Confid. Interval Pt. Est.		CL
Fall 1980	fw	33	4	315	±	308	Spring 1981	fw	46	3	464	±	374
Spring 1981	fw	35	6	388	±	266	Fall 1981	fw	33	3	492	±	434
Spring* 1982	fw	37	12	448	±	68	Spring* 1982	fw	51	8	421	±	7
Fall 1982	fw	17	6	781	±	536	Spring* 1983	fw	35	3	928	±	66
Spring* 1983	fw	28	12	578	±	90	Spring* 1984	fw	31	5	911	±	228
Mid-Winter 1984	hc	51	10	654	±	216							
Spring* 1984	fw	16	12	680	±	164							

[a]From Davis and Winstead (1980).
[b]Percent of marked animals observed - an estimate of survey efficiency.
[c]Percent of total observed which were marked.
*Multiple sampling was used to make estimate (Rice and Harder 1977): 2 survey flights (fixed-wing) were made in each unit during spring 1982; 3 flights in each unit in 1983 and 1984.

STUDY NO. BG-2.0 JOB NO. 3 (Supplement 2)

JOB TITLE: Habitat use and relationships of white-tailed deer on bottomlands along the lower Yellowstone River in eastern Montana.

JOB OBJECTIVES:

1. To determine relative use by white-tailed deer of the various seral stages of natural riparian communities along the yellowstone River bottomlands;
2. To determine the importance of agricultural lands and crops to white-tailed deer and how land-use practices affect deer distribution and habitat selection;
3. To determine how the distribution of riparian communities and agricultural land affects movements and distribution of deer;
4. To determine daily activity and movement patterns of deer.

INTRODUCTION

This study was initiated during July 1982 as a supplement to an ongoing study of population ecology and habitat relationships of white-tailed deer on bottomlands of hfe lower Yellowstone River (Dusek 1981, 1982, 1983). Dusek's studies of habitat use have emphasized seasonal distributions and movements based on aerial relocation and surveys, during dayling hours. This study is designed as a more intensive attempt to define specific patterns of habitat use throughout all hours of the day.

STUDY AREA

Two of the intensive study units described by Dusek (1981) were selected. The Elk Island unit comprises the Elk Island Wildlife Management Area and surrounding intensively cropped, irrigated agricultural lands. The Intake unit is private land on which livestock grazing and hay cropping are the primary agriculturl land uses.

The natural plant communities along the lower Yellowstone River and their successional relationships have been described by Boggs (1984).

METHODS

Field studies were continued during summer (June-September) 1983 and winter (January-March) 1984. Primary emphasis was placed on monitoring deer movements and habitat use. Deer locations were determined by triangulation over 24-hour periods, approximately twice monthly, employing three fixed-base "null-peak" and/or two mobile "Precision-direction-finding" antenna-receiving systems. Supplementary data were obtained by periodic aerial relocations, periodically locating individual deer from teh ground using a hand-held antenna-receiver, and spotlight observations on the study areas. Twenty-four deer at Elk Island and 22 deer at Intake were monitored for at least part of a season. Radioed deer were lost through mortality and added through trapping operations.

A cover/habitat type map of the two study areas was prepared during wpring-summer 1984. These data were digitized and entered into the computer for subsequent habitat use analyses. Relocation data were similarly compiled and entered into the computer for analysis.

RESULTS

Field studies were completed at the end of March 1984. All data are now being compiled and analyzed for preparation of the final thesis report. The final report will be completed during fall 1984 and submitted independently as a supplement to the 1984 Deer Studies Report.

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Prepared by James D. Herriges

APPENDIX

A LIST OF PUBLICATIONS RESULTING FROM STATEWIDE DEER RESEARCH STUDIES 1975-1984

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